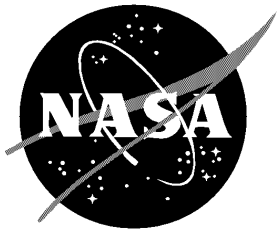

National Aeronautics
and Space Administration

June 18, 2004
NNH04ZSS003O

ANNOUNCEMENT OF OPPORTUNITY

Lunar Reconnaissance Orbiter Measurement Investigations (LRO)

Notice of Intent due: July 19, 2004
Proposals due: September 15, 2004

OMB Approval No. 2700-0085

Lunar Reconnaissance Orbiter Measurement Investigations

Announcement of Opportunity
Soliciting Proposals
for Period Ending
September 15, 2004

NNH04ZSS003O
Issued: June 18, 2004

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

LUNAR RECONNAISSANCE ORBITER MEASUREMENT INVESTIGATIONS

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1.0 Description of Opportunity

1.1 Overview

The National Aeronautics and Space Administration (NASA) solicits proposals for measurement investigations to be carried out by the Lunar Reconnaissance Orbiter (LRO) mission to obtain those measurements necessary and sufficient to characterize future robotic and human lunar landing sites and to identify potential lunar resources, with emphasis on applied science/engineering assessments. The LRO mission is expected to carry a variety of instruments and to be launched in the fall 2008, with a prime mission phase in lunar orbit of at least one Earth year. The launch services and spacecraft will be NASA-provided resources. Proposals in response to this Announcement of Opportunity (AO) will be due 90 days after its release, and participation in this AO is open to all categories of organizations domestic and foreign.

Proposals may be submitted for measurement investigations that involve a single instrument or, in special cases, a small, related set of instruments associated with achievement of a specific measurement objective. Individual instruments selected for any related group of specific measurement objectives that are provided by more than one Principal Investigator (PI) may have one of the PIs designated as a Team Leader by NASA and given additional integration and operation responsibilities. NASA reserves the right to add instruments to a selected proposal and/or not to select instruments proposed as part of a set of instruments proposed to address a specific measurement investigation goal (see Appendix A, Section II).

This AO does not solicit investigations by facility instrument scientists, interdisciplinary scientists, participating scientists/guest investigators, or data analysis program investigators, although such categories of investigations may be solicited at a later time.

Given the submission of proposals of merit and the availability of resources, NASA intends to select investigations to meet all of the measurement objectives described in Section 2 below. Selected investigations will be funded to begin Phase A/B design activities. Investigations that successfully complete Phase A/B, including a Preliminary Design Review (PDR)/Confirmation Review, may then be confirmed and funded for Phase C/D (Detailed Design and Development). NASA reserves the right to terminate investigations at PDR/Confirmation even if they have successfully completed Phase A/B should resource limitations present a problem.

1.2 Program Goals, Objectives, and Architecture

In January 2004, the President of the United States announced a new plan to advance the Nation's scientific, security, and economic interests through a robust space exploration program that integrates human and robotic exploration activities. This decision was documented by the *President's Space Exploration Policy Directive (NPSD31)(Goal and Objectives)*, and *A Renewed Spirit of Discovery – The President's Vision for U.S. Space*

Exploration (January 2004). The specific actions required to carry out this new exploration program have been further elaborated on in the NASA response document "*The Vision for Space Exploration,"* dated February 2004. All of these documents may be found in the LRO Library at the Web site http://centauri.larc.nasa.gov/lro/lrolib.html

A joint Enterprise working group at NASA Headquarters subsequently established the following Preliminary Level Zero Lunar Program Requirements:

1. Undertake lunar exploration activities to enable sustained human and robotic exploration of Mars and more distant destinations in the Solar System.
2. Starting no later than 2008, initiate a series of robotic missions to the Moon to prepare and support future human exploration activities:
   - Mission objectives shall include landing site identification and certification on the basis of potential resources;
   - Measurements shall be made to support applied science and research relevant to the Moon as a step to Mars, engineering safety, and engineering boundary conditions; and
   - Technology demonstrations and system testing shall be performed to support development activities for future human lunar and Mars mission.
3. Conduct the first extended human expedition to the lunar surface as early as 2015, but no later than the year 2020.
4. Use lunar exploration activities to further science and research.

These guiding requirements for the Lunar Program have been approved by NASA Headquarters management but await final endorsement on the basis of the recommendations from the *President's Commission on the Moon, Mars, and Beyond* (Aldridge Commission), which has been specifically charged with reviewing the implementation planning necessary to effectively meet the President's vision as outlined in NPSD31.

1.3 NASA's Safety Priority

Safety is freedom from those conditions that can cause death, injury, and occupational illness; damage to or loss of equipment or property; or damage to the environment. NASA's priority is to protect -

• The public;
• Astronauts and pilots;
• The NASA workforce (including contractor employees working on NASA contracts); and
• High-value equipment or property.

2.0 Investigation Measurement Objectives

NASA established an external group entitled the LRO Objectives/Requirements Definition Team (ORDT) that met in March 2004 to assist in defining specific LRO

mission goals and measurement objectives needed for the initial steps in lunar robotic exploration. From the results of this external group, NASA has established the following high priority objectives for the initial robotic elements in the Lunar Exploration Program:

- Characterization of the global lunar radiation environment and its biological impacts and potential mitigation, as well as investigation of shielding capabilities and validation of other deep space radiation mitigation strategies involving materials.
- Determination of a high spatial resolution global geodetic grid for the Moon in three dimensions:
    a. Global geodetic knowledge by means of spatially resolved topography, and
    b. Detailed topographic characterization at landing site scales.
- Assessment of the resources in the Moon's polar regions (and associated landing site safety evaluation), including characterization of permanently shadowed regions and evaluation of any water ice deposits.
- High spatial resolution global resources assessment including elemental composition, mineralogy, and regolith characteristics.

Of these four interrelated objectives, the first three are given highest priority for the LRO mission solicited through this Announcement of Opportunity (AO). To these ends, this AO solicits measurement investigations that will provide the following measurement sets (in no priority order):

- Characterization of deep space radiation environment in lunar orbit, including neutron albedo (in particular at energies in excess of 10 MeV), as well as:
    o Characterization of biological effects caused by exposure to the lunar orbital radiation environment; and
    o Characterization of changes in the properties of multifunctional radiation shielding materials caused by extended exposure to the lunar orbital environment;
- Geodetic lunar global topography (at landing-site relevant scales);
- High spatial resolution hydrogen mapping of the Moon's surface;
- Temperature mapping in the Moon's polar shadowed regions;
- Landform-scale imaging of lunar surfaces in permanently shadowed regions;
- Identification of putative deposits of appreciable near-surface water ice in the Moon's polar cold traps;
- Assessment of meter and smaller-scale features to facilitate safety analysis for potential lunar landing sites; and
- Characterization of the Moon's polar region illumination environment at relevant temporal scales (i.e., typically that of hours).

It is anticipated that individual instruments, rather than suites of instruments, are best suited to accomplish these mission measurement objectives. We encourage proposals that are capable of multiple measurements within a single instrument.

3.0 Background

Given the second of the Level Zero Lunar Program Requirements in Section 1.2 above, the Lunar Reconnaissance Orbiter (LRO) will be launched by late 2008 and will orbit the Moon for nominally one Earth year. Management of NASA's Robotic Lunar Exploration Program (RLEP) is the responsibility of the Office of Space Science (OSS), NASA Headquarters (HQ), Washington, DC. The Office of Exploration Systems (OES) determines the requirements for the RLEP. The implementation of the RLEP has been assigned by OSS to the NASA Goddard Space Flight Center (GSFC), Greenbelt, Maryland, which will manage the LRO, including provision of its launch system, spacecraft and payload accommodations, as well as mission systems engineering, assurance, and management. NASA HQ will be responsible for the evaluation and selection process associated with this AO. GSFC will award contracts for selected investigations. Any NASA organizations other than GSFC, as well as any other Government agencies, selected for funding through this AO, will be funded directly by HQ.

The LRO mission is focused on obtaining new data that will facilitate returning humans safely to the Moon, where testing, experiments, and operational preparations for eventual human missions to Mars may be undertaken.

Supporting material about the LRO mission and other materials that will aid prospective proposers can be found in the Proposal Information Package (PIP) and other documents within the LRO Library that is located on the LRO Acquisition Program website at http://centauri.larc.nasa.gov/lro/. Note that since these materials are subject to revision or change, proposers are strongly advised to visit this Website regularly to obtain any updates as may be announced. Proposers who file Notices of Intent (NOI) to propose (see Section 6.2 below) will be notified by E-mail of any such revisions/changes.

Questions regarding clarification of items in the AO or the LRO Library references including the PIP, should be submitted by mail/E-mail to the NASA Program Scientist for the Lunar Reconnaissance Orbiter:

Dr. James B. Garvin
Ref.: LRO-FBO 2004
Lead Scientist for Lunar and Mars Exploration
Solar System Exploration Division
Office of Space Science
Code SE
National Aeronautics and Space Administration
Washington, DC 20546-0001
Facsimile: 202-358-3097
E-mail: james.b.garvin@nasa.gov

Responses to all inquiries will be answered by E-mail and also posted weekly at the Frequently Asked Questions (FAQ) location of the LRO Acquisition Program website until two weeks before the proposal due date. Questions can also be raised at the Preproposal Conference (see Section 6.1 below). Anonymity of persons/institutions who submit questions will be preserved.

4.0 Proposal Opportunity Period

This AO is for a singular opportunity to submit proposals according to the schedule in Section 8 below.

5.0 Constraints, Guidelines, and Requirements

5.1 General Constraints and Guidelines

Only those investigations having proposed cost, design/development schedule, infrastructure requirements, and resource requirements within the constraints and guidelines identified in this AO will be considered as candidates for selection.

Funds are not currently available for awards under this AO. The Government's obligation to make award(s) is contingent upon the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this solicitation.

The selected investigation teams will have significant freedom to accomplish their proposed measurement objectives within the stated schedule and financial constraints. Essential NASA GSFC oversight will ensure that the teams remain responsive to the needs and constraints of the LRO mission, as well as those of the RLEP, as described further below. Once an investigation has been selected for development for flight, failure to maintain reasonable progress on an agreed upon schedule and cost, or failure to operate within the constraints outlined in this section, may be cause for its termination by NASA. Therefore, every aspect of a LRO measurement investigation must reflect a commitment to mission success.

LRO investigations must be headed by a single Principal Investigator (PI) who is responsible to NASA for all aspects of the measurement investigation including instrument design, development, test, and delivery to GSFC per the LRO project schedules found in the PIP in the LRO Library. This responsibility includes not only the integrity of the measurement investigation but also the complete investigation (development and operation). This includes provision of the experiment hardware, software, ground support equipment, including any necessary simulators, and support of mission operations planning and execution, data analysis, planning and implementation of an appropriate education and public outreach program, and timely archiving of calibrated

data into the NASA Planetary Data System (PDS) and publication of results. All Co-Investigators (Co-Is) named to an investigation must have a substantial, well-defined role in the measurement investigation.

Participation in this AO will be open to all categories of organizations, foreign and domestic, including educational institutions, industry, nonprofit organizations, Federally Funded Research and Development Centers (FFRDCs), NASA Centers, and other Government agencies. PIs are responsible for and may assemble their investigation teams from any and all of these organizations.

Contributions of any kind to LRO investigations by organizations other than NASA OSS are welcome. These contributions can be cash or noncash (i.e., property and services). In all cases contributions must be identified by source and amount in the proposal and must have letters of endorsement from all non-OSS organizations (both foreign and domestic participants) offering goods and/or services (including the support of members of the measurement team) for the proposed investigation. Proposals lacking such letters, or letters judged inadequate by NASA, may be cause for rejection of the proposal without further review. See Section 5.11 of this AO for other guidelines for non-U.S. proposals.

Investigations and investigators proposed by foreign organizations are to be provided on a no-exchange-of-funds basis to NASA and will be evaluated the same way as all other proposals for investigation merit, feasibility, and risk (see Sections 5.11 and 7.1 for additional guidelines).

All proposals will be required to include in their overall planning commitment to NASA's Education and Public Outreach and Small Business programs as discussed in Section 5.3 and Part 3 of Appendix B of this AO.

5.2 Measurement Investigation Requirements

In all proposals, a measurement investigation must be clearly defined and must fulfill one or more of the LRO Measurement Objectives (see Section 2.0 above). The relationship between the measurement objectives, the data to be returned, and the instrumentation to be used in obtaining the desired data must be unambiguous and clearly stated. LRO investigation teams will be responsible for initial calibration, validation, and analysis of the data; its subsequent delivery to the PDS in calibrated format (i.e., with adequate documentation); and the subsequent delivery of final measurement results. (Note that information on the PDS, its formats, and its requirements is included in the LRO Library.)

Proposals to this AO must also include an adequately budgeted data analysis/production period, independent of PDS archiving activities, as a part of the Phase E activities that is understood to include delivery of calibrated measurement results. Publication of measurement results in suitable refereed journals is also expected. Failure to adequately include such activities shall be reason for declaring a proposal as being non-responsive to this AO and its return without further review.

Following established NASA policy, there shall be no period of exclusivity for data rights for LRO measurement investigations. LRO investigation teams will be responsible for collecting the measurement, engineering, and ancillary information necessary to validate and calibrate the measurement data prior to delivery to the PDS. Data products delivered to the PDS shall be documented, validated, and calibrated in physical units useable by the measurement community at large. The time required to complete this process and make the data available to the Moon/Mars exploration communities and the general public should be six months or less. Proposers who offer to deliver suitably calibrated measurement datasets before this time will be appropriately credited for their plans (see Section 7.1), since this will support a wider-community data analysis activity, as well as expedite progress in the Vision for Space Exploration.

The scientifically driven desire for elemental cleanliness will place constraints on instrument development, integration, and operations. Although the LRO mission has no specific contamination requirements thus far, the spacecraft and instruments may require limits on allowable contamination depending on the needs of the payload.

Under NASA Planetary Protection provisions (cf., NPR 8020.12B) there are no planetary protection provisions associated with the Moon, while under COSPAR's Planetary Protection Policy of October 2002 the Moon is Category I (no requirements) for outbound missions, and anticipated as Category V, "unrestricted Earth return" for inbound missions. In compliance with COSPAR's policy and their anticipated incorporation into the upcoming NPR 8020.12C, it is expected that the LRO Project will request and receive a Category I classification from the NASA Planetary Protection Officer, and that there will be no restrictions on the spacecraft operations or payload associated with biological planetary protection.

Proposers are encouraged to make limited use of hazardous, toxic, ozone depleting, and nuclear materials to reduce the overall environmental risk of the mission and enable NASA to better fulfill its mission of understanding and protecting the Earth. Information about such materials will be required in order to assist NASA in the environmental review of the mission. The contracting process will require demonstrated compliance to all known federal, state, and local environmental, health, and safety laws.

5.3 Education, Public Outreach, and Small Disadvantaged Business Requirements

5.3.1 Education and Public Outreach Requirements

The National Aeronautics and Space Administration’s (NASA) Vision Statement, “To improve life here, to extend life to there, and to find life beyond,” and Mission Statement,

- To understand and protect our home planet;

- To explore the Universe and search for life
- To inspire the next generation of explorers

…as only NASA can.

provide the context for the NASA Education program. As part of its response to this mandate, OSS is committed to fostering the broad involvement of the space science research community in Education and Public Outreach (E/PO) with the goal of enhancing the nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology Progress towards achieving this goal has become an important part of the broad justification for the public support of space science. In addition, an enhanced, coordinated Agency-level education program is now being undertaken through the new NASA Office of Education that constitutes the Agency's sixth enterprise. NASA's Education objectives and the OSS areas of emphasis in E/PO directed towards meeting those objectives are given in table below in Appendix C.

In accordance with established OSS policies, E/PO is an integral element of any space science project and 1 to 2 percent of the NASA OSS Cost (excluding launch vehicles) will be allocated to E/PO. Every proposal to this AO must contain an E/PO component following the guidelines contained in Section 2.6 of Appendix B.

OSS strongly encourages space science researchers to engage actively in education and public outreach as an important component of their NASA–supported professional activities. The key documents that establish the basic policies and guidance for all OSS E/PO activities are *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), *Implementing the Office of Space Science Education/Public Outreach Strategy* (October 1996), and the *Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria* (March 2004). Additional information concerning NASA Education and Public Outreach may be found in the *NASA Education Enterprise Strategy* (October 2003) at http://education.nasa.gov/about/strategy/index.html and the *Space Science Enterprise Strategy* (October 2003) at http://spacescience.nasa.gov/admin/pubs/index.htm. These documents are available through the LRO Library or, alternatively, may be accessed electronically by selecting "Education" from the menu on the OSS homepage at the World Wide Web address http://spacescience.nasa.gov/, or may be obtained in hard copy from Dr. Philip J. Sakimoto, Office of Space Science, Code S, NASA Headquarters, Washington DC 20546; (E-mail: philip.j.sakimoto@nasa.gov).

Instructions for the E/PO component of the proposal are contained in Appendix B and Appendix C. Also note that significant elements of this AO's goal for involvement of minority institutions (see Section 5.3.2) may be met through an appropriately planned E/PO program.

Additionally, the GSFC will have a RLEP program-level Public Engagement Plan. Therefore, proposers to this AO will also be required to coordinate their E/PO activities with and complement this overarching GSFC Public Engagement Plan. A detailed E/PO implementation plan will be developed by each investigation selected through this AO and delivered in conjunction with its Phase A/B activities. As outlined in Section 7.4, the proposed plans for E/PO may be used to discriminate among proposals that are otherwise equal in the final selection process.

Questions and/or comments and suggestions about the OSS E/PO program are welcome and may de directed to Dr. Larry P. Cooper (telephone: (202) 358-1531; E-mail: larry.p.cooper@nasa.gov .)

5.3.2 Small Business

Offerors other than small business concerns are advised that contracts resulting from this AO will be required to contain a subcontracting plan that includes goals for subcontracting with small, small disadvantaged, women-owned, and Historically Underutilized Business Zone, veteran-owned, and service-disabled veteran-owned small business concerns (see Section XIII of Appendix A). Investment in these organizations reflects NASA's commitment to increase the participation of minority concerns in the aerospace community and is viewed as an investment in the nation's future. Proposers to this AO are expected to use their best efforts to assist NASA in achieving its goal for the participation of all forms of small business in NASA procurements. Note that substantial involvement of minority colleges and universities in space science missions and research programs is also a key objective of the OSS E/PO program.

5.4 Mission Overview

The LRO mission will be launched from the NASA Kennedy Space Center, on an intermediate-class launch vehicle, in late 2008. Payload instruments will be in a power-off state during the launch and injection phase. The cruise phase begins when the spacecraft separates from the launch vehicle and ends prior to Lunar Orbit Injection (LOI). The cruise phase lasts approximately three days.

After achieving the final mapping orbit, the LRO baseline mission is nominally one Earth year in a 30-50 km near-circular polar orbit. After instrument selection, consideration will be given to reducing the mission duration in the nominal orbit in order to enable a short duration at a lower altitude or, alternatively, an extended mission in a higher elliptical orbit.

The LRO spacecraft will be a 3-axis stabilized platform with both stored data and real-time downlink capabilities.

The cost constrained nature of this mission requires that the payload development and measurement mission be accomplished within allocated costs. In addition, the payload will be allocated available resources for mass, energy, volume, data rate, duty cycle, and other key resources, as specified in the PIP. Therefore, proposed instruments must demonstrate adequate reserves and margins consistent with contemporary design principles and engineering practices (additional details are given in Appendix B of this AO).

The PIP contains preliminary descriptions of the 2008 Mission, the environments in which the instruments are expected to survive and operate, Principal Investigator (PI) responsibilities and deliverables, and the capabilities of the LRO ground system and mission operations, as well as details of funding allocations and profiles. In case of a conflict between this AO and the PIP, the AO takes precedence.

No radiation isotope power sources for any instrument are allowed for this mission.

5.5 Payload Resource and Accommodation Constraints

For all instruments proposed in response to this AO, innovative design approaches that incorporate technological advances in low cost, lightweight, high performance instruments are encouraged. The most tightly controlled resources for the LRO payload are expected to be available funds and mass. Interested proposers are encouraged to read and understand the PIP thoroughly to better plan for all payload accommodation and resource limitations and constraints.

The current best estimate of the total mass allocation for the investigations solicited by this AO is 100 kg, including mass reserves as recommended by the proposers. Mass and requirements for reserve are discussed in the PIP.

The current best estimate of the total power/energy allocations for the investigations is based on a strawman mission scenario. Power and energy allocation is further discussed in the PIP.

An on-board memory capability will be allocated for storage of instrument data prior to downlink, which, in conjunction with the planned communication capability, is expected to accommodate 10 Mbps, or less of data (orbit average for the entire instrument payload). A modest data volume may also be accommodated for low-latency (i.e., same-day) data return from Payload to enable critical operations planning cycles. Data volume allocations and constraints are further discussed in the PIP.

5.6 Investigation Phases and Schedule Constraints

The following phases are defined for investigations selected for LRO through this AO:

Formulation Phase

Phase A: Investigation Definition - (Duration: 2 months)
From contract award after selection to preliminary design start; ends at Payload Accommodation Optimization with all requirements locked in. There is also an Initial Confirmation Review for the Phase A to Phase B transition.

Phase B: Investigation Preliminary Design – (Duration: 3 months)
From end of Phase A to start of Phase C/D; ends with Instrument Preliminary Design Review and Confirmation Review.

Implementation Phase

Phase C/D: Investigation Detailed Design, Build, Test, and Integration – (Duration: 43 months)
From End of Phase B through Launch plus 30 days.

Phase E: Investigation Operations and Data Analysis – (Duration: 12 months)
From Launch plus 30 days to end of Primary Mission Phase (approximately one Earth year).

In order to meet a launch readiness in nominally October 2008, adherence to the LRO Project schedule and specific delivery milestones will be required (see the PIP for specific requirements).

5.7 Cost Constraints

It is the intent of NASA to select a combined payload that best satisfies the LRO measurement requirements within the most favorable combination of payload mass and combined instrument cost. Presently, the LRO Project is budgeting guidelines of no more than $90 M [note: all cost numbers in this AO are in Real Year (RY) dollars unless otherwise specified] for the development of the instrument payload from Phase A/B through LRO operations and data analysis (nominally one year plus six months for data archival), including all investigations reserves.

Finally, note that 1 to 2 percent of the LRO total run-out cost for each selected instrument investigation (see Section 5.3.1) is to be reserved for E/PO activities. It is expected that the bulk of these activities will occur in the operational phase (Phase E) of the LRO mission.

Cost realism and overall cost effectiveness are important criteria in the selection of the Principal Investigator measurement investigations. Therefore, a realistic schedule and budget for development are required, including the identification and proposed development of long-lead items. Investigators must recommend reserves for funding

within the overall allocation based on the maturity of the proposed design and the technologies incorporated in the design approach. The reserves will be evaluated and the findings factored into the assessment cost realism during the proposal evaluations (see Section 7). Therefore, proposers should define descope options in their proposals (if any are practical), the decision dates for their implementation, the level of costs that would thereby be avoided, and the measurement impact associated with each descope (see further details in Appendix B of this AO).

Due to the cost constrained nature of LRO, proposed life cycle costs for any investigation may not increase after selection without being subject to cancellation.

5.8 Measurement Operations Requirements

It is expected that each PI of a measurement investigation selected through this AO will develop and maintain a science operations facility at their own home institution. This facility should provide for instrument command generation and transmission to the LRO Project at GSFC, be able to retrieve essential instrument telemetry data for instrument performance assessment and health and welfare assessment, retrieve instrument measurement data, allow remote participation in the operations measurement decision process, and provide a means for validating measurement data and preparing these data for archiving. The PI operations facility and network configuration must meet project-specified security requirements. The plans and budget for the design and staffing of these individual PI operations facilities must be provided in the proposals.

5.9 Data Policies and Validation Requirements

The LRO Project requires that raw data, calibration records, and processed data be maintained in an updated form throughout the period of investigation. Specifically, each selected PI must plan:

- To maintain a continually updated record of the "best version" of the data until meaningful changes in data calibration no longer occur;
- To release data in an appropriate manner for public access as soon as feasible;
- To make appropriate data records available to other investigators and project personnel during the mission for shared analysis; and
- To support the timely processing and distribution of data, including their deposition in the Planetary Data System (PDS), as soon as feasible but no later than six months after data acquisition.

It is NASA policy that PIs do not have exclusive use of data taken during the course of their investigations (see also Section XII of Appendix A). Therefore, all data from LRO

measurement investigations is considered to be nonproprietary and must be made available to the science/exploration community and public as soon as possible. In order to engage the public more fully, investigators are strongly encouraged to release subsets of particularly interesting initial data on a daily to weekly basis. Plans for, and actual release of, data for public engagement will also be coordinated through the LRO Project Measurements Group (see Section 7.6 below). Therefore, as part of a proposer's data release plan, discussion of the volume and timing of data for early release must be addressed, and the necessary data reduction costed accordingly. NASA, through the LRO Project, reserves the right to direct or conduct processing and release of data needed for mission or program planning and also to support public engagement.

While Level Zero (i.e., raw data) will be archived by the LRO Project, PIs selected for measurement investigations must plan to archive their Data Products in the Planetary Data System (PDS) in a PDS-compatible data format. Plans must conform to policy and requirements for the validation and archiving of data presented in the document, *"Lunar Exploration Program Data Management Plan*" (see LRO Library). After a short period for verification and validation, not to exceed six months, the PI must deposit the validated data in the PDS; analysis, preparation, distribution, and archiving of all instrument team data products are to be completed within six months of data acquisition. Exceptions to this guideline are to be identified and appropriate justification given. Data Products will be archived in the PDS as soon as they are available, on a time scale commensurate with the level of data processing to be identified in the jointly developed Data Management and Archive Plan.

Initial data analyses for the LRO measurement investigations will be accomplished by the PIs and their teams. Therefore, proposers are expected to include, as part of their proposed Mission Operations and Data Analysis activities, a clear definition of the roles of all the measurement team members and a data analysis plan that is consistent with PDS archiving activities. Cost estimates for PI team activities will cover all phases, including Mission Operations and Data Analysis.

5.10 Technical and Management Requirements

5.10.1 Technical Requirements

A proposal in response to this AO must address all technical aspects of its investigation from the beginning of Phase A/B through to the delivery of the data for archiving, the generation of higher-order data products in support of the Exploration vision, the publication of appropriately analyzed measurement results in the peer-reviewed literature, and the conduct of an appropriate E/PO program. The document, NPR 7120.5B, *NASA Program and Project Management Processes and Requirements,* describes the activities, milestones, and products typically associated with Formulation and Implementation of projects and may be used as a reference in defining a team's mission approach (available through the LRO Acquisition Library). Proposers are encouraged to propose innovative

processes, techniques, and activities to accomplish these objectives and to demonstrate cost, schedule, and technical efficiencies.

Each LRO investigation shall have a cost-effective mission assurance program that is consistent with the PIP and PIP-related documents. Mission specific requirements for mission assurance in particular are included in the PIP.

No LRO measurement investigation may provide an instrument requiring a radioisotope power supply. However, investigation hardware that requires small quantities of nuclear material for heating, calibration, or other reasons is permissible provided that such item(s) are clearly specified in the proposal.

As part of the accommodation and integration of an instrument on the LRO spacecraft, the Project will provide a suitably designed mount as defined in the PIP. However, the cost and development of any instrument-unique deployable masts and other mechanisms required by an instrument will be the responsibility of the proposer. The proposer must also ensure that any such masts or mechanisms do not interfere with the operation of the spacecraft.

The PI is responsible for the success of his/her measurement investigation. The proposal must describe the technical approach for every element of the investigation to ensure that it does not exceed the bounds of the available spacecraft or financial resources. Investigators must propose reserves for mass, power, and other technical resources based on the maturity of the proposed design and the technologies incorporated in the design approach (see also Appendix B in this AO). The proposal must demonstrate that any proposed hardware will operate reliably, must clearly spell out the roles of all Co-Is, and must show that the resulting data can be interpreted in a way to achieve the investigation's stated objectives.

5.10.2 Management Requirements

With appropriate NASA GSFC oversight, NASA intends to give the PI and his/her team the ability to use their own management processes, procedures, and methods to the fullest extent possible. Therefore, each proposing investigation team is encouraged to define the management approach best suited for their particular investigation and teaming arrangement. This approach should be commensurate with the investigation's implementation approach**,** while retaining a simple and effective management structure that ensures adequate control of the investigation's design and development within the cost and schedule constraints. The proposal must contain a Work Breakdown Structure (WBS) that best fits its organizational approach and the overall mission design (see Appendix B in this AO for further details). The PIP provides guidance on Project imposed requirements for reviews, deliverables, and other Measurement and Payload Management related items.

5.11 Guidelines Applicable to Non-U.S. (Foreign) Proposals and Proposals Including Non-U.S. Participation

NASA welcomes proposals having participants from non-U.S. institutions provided that they are offered on a no-exchange-of-funds basis and also comply with current U.S. restrictions concerning the export of technology. In addition to meeting the requirements discussed elsewhere in this AO, including the Appendices that apply to all proposers, foreign proposals and proposals including foreign participation must comply with the additional policies below.

Note that to the maximum extent possible any proposed international participation in the LRO mission must be described at the same level of detail as that of a U.S. proposed investigation. NASA will seek to validate contribution costs, schedule, and management data during evaluation of the proposals and in subsequent reviews. Failure to provide such information about proposed contributions, or failure to document the commitment of all team partners to those costs and schedules, may cause a proposal to be found unacceptable for review or selection through this AO.

5.11.1 General Policies

(1) Although NASA welcomes proposals from outside the U.S., foreign entities are generally not eligible for funding from NASA. Thus, such investigations and investigators must be proposed on a no-exchange-of-funds basis to NASA. In addition, proposals from foreign entities, and proposals from U.S. entities that include foreign participation, must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and, if the proposal is selected, that sufficient funds will be made available by the respective foreign government agency or funding/sponsoring institution to undertake the activity as proposed. These Letters of Endorsement are required from all organizations sponsoring non-U.S. participants and must be received at the address given in Section 6.6 by the schedule given in Section 8.0. Also see Appendix B, Section 2.7, item 4.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in this AO. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All foreign proposals must be received by the established closing date for proposals. Those received after the closing date will be treated in accordance with Appendix A, Section VII.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA office that sponsors the solicitation. Copies of these letters will be sent to the foreign sponsor.

(4) Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the

proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities.

Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or
(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

5.11.2 Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation

(1) Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 Code of Federal Regulations (CFR) Parts 120-130; 15 CFR Parts 730-774; and 10 CFR 110 and 810, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or, if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at http://www.pmdtc.org and at http://www.bis.doc.gov. Proposers are advised that, under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

6.0 Proposal Submission Information

6.1 Preproposal Conference

In order to provide the community of interested proposers with the latest and best information about this LRO mission, as well as to answer questions about this AO, NASA will host a Preproposal Conference to be held in the Washington, DC, area approximately two weeks after AO release. Details regarding this conference will be provided on the LRO Acquisition Website. Note that all expenses and arrangements for attending this meeting are the responsibility of the attendee, and NASA research or project funds may not be used to defray any of the associated costs.

Questions may be submitted in advance in writing or by E-mail to the LRO Program Scientist identified in Section 3.0 of this AO. Every effort will be made to answer all questions submitted at least one week in advance of the Conference at the meeting. Questions submitted at the Conference itself will be answered to the extent possible;

those not answered at that time, as well as the answers to all questions at the Conference including those submitted in advance, will be posted on the Web site of this AO within two weeks of the Conference. In all cases, the anonymity of the authors of questions will be preserved.

6.2 Notice of Intent to Propose

A Notice of Intent (NOI) signifying the writer's intent to submit a proposal in response to this AO is requested to be submitted by all proposers via the World Wide Web site http://research.hq.nasa.gov/code_s/code_s.cfm by the schedule noted in Section 8 below. Proposers without access to the Web or who experience difficulty in using this site are directed to the Help Desk at http://proposals.hq.nasa.gov/help.html; e-mail: proposals@hq.nasa.gov; Phone: (202) 479-9376 (Monday to Friday 8 AM-6 PM ET).

To the extent the following information is known by the NOI due date, the Website for NOIs will request the following information:

- Name, address, telephone number, fax number, E-mail address, and institutional affiliation of the PI.
- Full names and institutional affiliations of any Co-Investigators (Co-Is). All Co-Is must have substantial and well-defined roles in the investigation. If any Co-Is or other team members are from non-U.S. institutions, the organization that will provide support for these people should be identified in the "Comments" box on the NOI form.
- A brief statement (150 words or less) that includes all of the following:
  - The measurement objectives of the proposed investigation;
  - Identification of any new technologies that may be proposed as part of the investigation; and
  - The Education/Public Outreach objectives of the proposed investigation.
- The name of the Lead Representative from each partner organization (industrial, academic, nonprofit, and/or Federal) included in the proposing team.

Note that all information provided in an NOI is for NASA planning purposes only, is confidential, and is replaced by information in the final proposal.

6.3 Format of Proposals

Appendix B provides detailed information concerning the contents and format of proposals submitted in response to this AO.

6.4 Signature Authorization

All proposals must be signed by an institutional official authorized to certify institutional support and sponsorship of the investigation, as well as of the management and financial

parts of the proposal. This is accomplished through the authorizing institutional signature on the proposal *Cover Page* (see Section 2.1 and 2.7 in Appendix B).

6.5 Required Certifications

All proposals requesting NASA funding must demonstrate compliance with the policies set forth in the certifications and assurances supplied in Appendix D of this AO. Note that this Appendix is only for reference; the authorizing institutional signature on the *Cover Page* form (see Section 2.1 in Appendix B) certifies that the submitting institution has read and is in compliance with these policies.

6.6 Submission of Proposals

The signed original plus 50 copies of instrument proposals must be received at the following address by the schedule in Section 8.0 below:

Lunar Reconnaissance Orbiter
Office of Space Science
NASA Peer Review Services
Suite 200
500 E Street, SW
Washington, DC 20024-2760
Tel: 202-479-9030

Every paper copy must be accompanied with a searchable PDF-formatted Compact Disc-Read Only Memory (CD-ROM) of the proposal, attached in a way so that it is not easily lost or separated from the hard copy. NASA's policy concerning late delivery of proposals is given in Appendix A, Section VII.

7.0 Proposal Evaluation, Selection, And Implementation

7.1 Evaluation Criteria

The fundamental aim of the NASA investigation acquisition process is to identify research ideas that are tested and verified by unique instrumental and/or analytical capabilities that best suit the defined program objectives, and the technical, management, and cost constraints of the program as described in the AO. Therefore, the following criteria will be used in evaluating all proposals submitted in response to this AO.

Exploration Merit (Weight 40%): The exploration merit of the proposed investigation will be judged by its impact and relevance to the overall LRO prioritized measurement objectives. Impact is determined by whether the proposed investigation fills knowledge gaps, provides fundamental progress in knowledge of the Moon, and provides specific ancillary benefit for planned human exploration,

and/or supports or overlaps with other lunar investigations. Relevance will be judged on the relationship of the proposed investigation to the primary measurement objectives of the LRO mission as given in Section 2 in this AO, and the approved goals of the Robotic Lunar Exploration Program provided in the LRO Library.

Technical Feasibility (Weight 30%): Technical feasibility will be judged by the adequacy and resiliency of the proposed investigation with particular regard to its instrumentation's ability to supply the data needed for the proposed measurement investigation within mission constraints. In particular, the proposed investigation must provide for a clear and logical flow-down from stated measurement objectives, to the requirements for observations, to the measurements proposed to be made, to the reduced and analyzed data. In addition, the competency and roles of the measurement team, including any proposed Co-Is to conduct the proposed investigation to a successful conclusion will be assessed, as will the adequacy of plans for data analysis, archiving, distribution, and publication to provide timely access to the investigation's data and measurement results.

Implementation Risk (Weight 30%): The soundness of the technical and management implementation approach, schedule, and cost realism and reasonableness will be the primary factors considered in determining the implementation risk. Specifically, the following will be evaluated: The technical approach to design, develop, integrate, and test the proposed instrumentation hardware and software to meet the investigation requirements within the mission's constraints defined in this AO and LRO PIP; the adequacy and robustness of the proposed resources (technical, management, and cost); the competence and relevant experience of the proposed technical and management teams; and the soundness of plans and commitments to ensure that the investigation can be successfully completed and delivered within budget and meet the project schedule milestones. The proposal must also demonstrate the capability and plan to adhere to sound business practices. Cost realism and cost reasonableness will be used to determine an overall cost risk (uncertainty) associated with the investigation. The basis of cost estimate, adequacy of reserves at the start and at least 25% of the cost to go at Confirmation Review (Confirmation for Phase C), and the effectiveness of any proposed descopes will be assessed.

7.2 Evaluation Procedures

Proposals received in response to this AO will be evaluated in accordance with the provisions of NASA Federal Acquisition Regulations (FAR) Supplement (NFS) Part 1872, "*Acquisition of Investigations,*" that may be accessed through the Internet host http://www.hq.nasa.gov/office/procurement/regs/1872.htm.

All proposals will be subjected to a preliminary screening to determine their suitability and responsiveness to the AO. In particular, the factors shown in Appendix F of this AO will be screened for compliance. Proposals that are not in compliance with the

constraints, requirements, and guidelines of this AO will be handled as technical correspondence and returned to the proposer without further review.

Following these preliminary actions, the investigation merit and feasibility, as well as the technical, management, and cost aspects of each proposal, will be assessed by panels of reviewers. The purpose of this peer evaluation will be to determine the investigation merit and investigation feasibility, and to judge the risk of implementation of each proposal. Findings will be expressed in terms of major and minor strengths and weaknesses, and summarized by an appropriate adjectival score: Excellent, Very Good, Good, Fair, and Poor.

Note that at any time during the evaluation process, NASA reserves the right to invite the PIs of proposals to answer questions of clarification about their proposals, including plans for E/PO activities. If such an activity is planned, the request to participate, as well as all questions to be answered, will be submitted in writing to the proposers. The response to the questions will be returned by mail. This exercise will be invoked only for NASA to clarify perceived uncertainties in understanding or interpretation of the material in the proposals and will not be an opportunity for the proposer to revise or otherwise augment a submitted proposal. See also Section III of Appendix A in this AO.

All proposals in which the Phase A/B costs are expected to exceed $500,000, and the proposers are organizations other than small business concerns, must submit a Small Business Contracting Plan (see Appendix A, sec. XIII). This subcontracting plan will be evaluated on the participation goals and quality and level of work performed by small business concerns, HBCUs, and other minority educational institutions.

The Educational/Public Outreach planning for selectable proposals (see Section 7.3 below) will be appraised by a separate panel of E/PO professionals, as well as scientists who have demonstrated experience in these activities. The results of this appraisal will be debriefed to selected proposal teams only in order to allow them to better prepare for Phase A/B activities (see Section 7.4 below).

7.3 Categorization Process

After all the peer evaluations are completed based on the criteria given in Section 7.1 above, an *ad hoc* Categorization Subcommittee of the Space Science Steering Committee (SScSC; see Section 7.4 below), consisting of U.S. Civil Servants, will categorize the submitted proposals according to the definitions in NASA FAR Supplement 1872.403, as follows:

> Category I: Well conceived and scientifically and technically sound investigations pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that the data can be properly reduced, analyzed, interpreted,

and published in a reasonable time. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II: Well conceived and scientifically and technically sound investigations, which are recommended for acceptance, but at a lower priority than Category I.

Category III: Scientifically or technically sound investigations that require further development. Category III investigations may be funded for development and may be reconsidered at a later time for the same or other opportunities.

Category IV: Proposed investigations which are recommended for rejection for the particular opportunity under consideration, whatever the reason.

Note that all peer evaluations are the basis of the proposal's categorization. Also, considering the unique nature of this LRO mission opportunity, the selection for funding of any Category III investigations is not anticipated.

7.4 Selection Process

As needed and appropriate, the LRO Project Office will conduct accommodation assessments for each of the Category I and II individual investigations, and, at the direction of the LRO Program Scientist, also conduct accommodation analyses of a number of combinations of Category I and II investigations, in order to establish the impact/penalty for selecting any/all possible selection options.

Following these evaluations, the LRO Program Scientist, will develop a recommendation for selection. This recommendation and all peer review and categorization materials for all proposals will then be presented to the Space Science Steering Committee (SScSC), composed of Civil Service personnel appointed by the Associate Administrator for Space Science, that will conduct an independent review of all processes and records.

After successfully completing this review, the final evaluation results, including the accommodation assessment results, all other programmatic considerations including budget, schedule, and the commitment and plans for the E/PO and Small Business participation will be forwarded to the source selection official(s). The Associate Administrator for Space Science and the Associate Administrator for Exploration Systems, will jointly make the selection(s) for this procurement.

The selection will also take into account the total cost and cost profile of each candidate investigation. The merit of plans and commitment for E/PO activities and Small Business Plans that reflect a commitment to involve small businesses of all types in the proposed investigation will be used to discriminate among proposals that are otherwise equal in the final selection process. Proposers are also advised that the selection process

may also take into account programmatic and/or budgetary circumstances that may arise after this AO is issued.

Proposers are advised that, in accordance with Section II of Appendix A, NASA may desire to select only a portion of the proposer's investigation and/or may also desire the proposer's participation with other investigators in a joint investigation. In such a case, the proposer(s) will be given the opportunity to accept or decline the offer. Declination of such an offer may lead to non-selection for this flight opportunity.

Selected PI Instrument investigations will be funded to conduct Phase A/B studies. These Phase A/B studies will focus on whether the proposed hardware can be accommodated on the LRO spacecraft and completed and delivered on a schedule consistent with the mission schedule given in Section 5.6. An Instrument Preliminary Design Review and Confirmation Review for Phase C will be held at the completion of Phase B; approval to proceed to Phase C/D will depend on successfully passing this review.

7.5 Implementation Procedures

Selected proposers will be notified by telephone and by letter. Letters of selection will provide instructions concerning the steps necessary to initiate funding of award and to schedule a debriefing by NASA with regards to the strengths and weaknesses noted in the proposals. Non-Government awardees will receive contracts from GSFC.

Those proposers not selected will be notified by letter and offered a debriefing based on the strengths and weaknesses of their proposals. This debriefing may be by telephone or in person at NASA Headquarters at the discretion of the proposer; however, in the latter case, NASA research or project funds may not be used to defray travel costs.

7.6 Formation of Project Measurement Group

Subsequent to the selection of investigations by NASA through this AO, a LRO Project Measurement Group (PMG) will be established, composed of the PIs of the investigations selected through this AO. The PMG will be chaired by the LRO Program Scientist from NASA Headquarters. The PMG will meet regularly through the lifetime of the LRO Mission with a charter to work with the Robotic Lunar Program Office to maximize the measurement return of the LRO mission within the existing resources.

8.0 SCHEDULE

The following schedule applies to this Announcement of Opportunity:

AO release.....June 18, 2004
Pre-proposal Conference.....July 7, 2004
Notice of Intent due by 4:30 p.m. ET.....July 19, 2004

Proposal Due Date (by 4:30 p.m. ET).....September 15, 2004
Non-U.S. Letters of Endorsement due .....Proposal Due Date (included with proposal)
Selections announced (target) .....Proposal Due + 2 months
Instrument Phase A/B start (target).....Selection + 2 weeks

Proposals are to be delivered to the address given in Section 6.6 above. Note that proposals received after the deadline indicated above will be handled in accordance with the policy for late proposals as given in Section VII of Appendix A.

9.0 CONCLUSION

The LRO mission will conduct new forms of directed, measurement-based reconnaissance of the Moon in support of the overarching goal of the renewal of human lunar exploration beginning no later than 2020 and possibly as early as 2015. In addition, LRO will advance substantially our understanding of the engineering boundary conditions necessary to develop flight system capabilities in support of the goal of renewed human surface exploration of the Moon as a stepping-stone to human exploration of Mars. Finally, the LRO will address in a comprehensive manner the resource potential of the Moon and, potentially, its capacity to support human activities as a step toward human missions to Mars. NASA's Office of Space Science invites the entire scientific and exploration communities, including foreign scientists and engineers, to participate in this important and exciting mission.

Craig E. Steidle
Associate Administrator for
Exploration Systems

Edward J. Weiler
Associate Administrator for
Space Science

APPENDIX A

GENERAL INSTRUCTIONS AND PROVISIONS

I. INSTRUMENTATION AND/OR GROUND EQUIPMENT

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of Government instrumentation or property that becomes available, with or without modification, that will meet the investigative objectives.

II. TENTATIVE SELECTIONS, PHASED DEVELOPMENT, PARTIAL SELECTIONS, AND PARTICIPATION WITH OTHERS

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed experiment and to discontinue the investigative effort at the completion of any phase. The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its team leader or contact point.

III. SELECTION WITHOUT DISCUSSION

The Government reserves the right to reject any or all proposals received in response to this AO when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion (other than discussions conducted for the purpose of minor clarification). It is, therefore, emphasized that all proposals must be submitted initially on the most favorable terms that the offeror can submit.

IV. NON-U.S. (FOREIGN) PROPOSALS

The guidelines for proposals originating outside of the United States are the same as those for proposals originating within the United States, except that the additional conditions described in Section 5.11 and Appendix B, Section 2.7.4 through 2.7.6 of the AO shall also apply.

V. TREATMENT OF PROPOSAL DATA

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should place the following notice on the title page of the proposal or quotation and specify the information subject to the notice by inserting appropriate identification, such as page numbers, in the notice. Information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice. To prevent inadvertent disclosure, proposal data shall not be included in submissions (e.g., final reports) that are routinely released to the public.

> Restriction On Use and Disclosure of Proposal and Quotation Information (Data):
>
> The information (data) contained in (insert page numbers or other identification) of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

VI. STATUS OF COST PROPOSALS

The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that, following selection and during negotiations leading to a definitive contract, the institution may be required to resubmit or execute all certifications and representations required by law and regulation.

VII. LATE PROPOSALS

The Government reserves the right to consider proposals or modifications thereof received after the date indicated for such purpose, if the selecting official deems it to offer NASA a significant technical advantage or cost reduction, as compared with proposals previously received (see NFS 1815.208).

VIII. SOURCE OF SPACE INVESTIGATIONS

Investigators are advised that candidate investigations for space missions can come from many sources. These sources include those selected through the AO, those generated by

NASA in-house research and development, and those derived from contracts and other agreements between NASA and external entities.

IX. USE OF OUTSIDE EVALUATORS

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desires to preclude NASA from using an outside evaluation, the investigator or institution must so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

X. EQUAL OPPORTUNITY

For any NASA contract resulting from this solicitation, the clause at FAR 52.222-26, "Equal Opportunity," shall apply.

XI. PATENT RIGHTS

A. For any contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at 1852.227-70, New Technology, shall apply. Such contractors may, in advance of a contract, request waiver of rights as set forth in the provision at 1852.227-71, Requests for Waiver of Rights to Inventions.

B. For any contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, Patent Rights—Retention by the Contractor (Short Form) (as modified by 1852.227-11), shall apply.

XII. RIGHTS IN DATA

Any contract resulting from this solicitation will contain the Rights in Data – General Clause: FAR 52.227-14.

XIII. SMALL AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING

A. Offerors are advised that, in keeping with Congressionally mandated goals, NASA seeks to place a fair portion of its contract dollars, where feasible, with small, small disadvantaged, women-owned, HUBzone, veteran owned small business concerns, and Historically Black Colleges and Universities (HBCUs), and other minority educational institutions, as these entities are defined in FAR 52.219-8 and 52.226-2.

B. Section 8(d) of the Small Business Act requires insertion of the clause at FAR 52.219-9, Small Business Subcontracting Plan, in NASA contracts that offer subcontracting possibilities, exceed $500,000, and are with organizations other than small Business Concerns. Offerors seeking Phase A/B contracts that meet these criteria must include subcontracting plans as part of their proposals for this phase. The subcontracting plans will be evaluated on the participation goals and quality and level of work performed by small business concerns, HBCUs, and other minority educational institutions. Offerors will also be evaluated on proposed participation targets of small business concerns (SDBs) in the applicable North American Industry Classification System (NAICS) Subsector as determined by the Department of Commerce (see FAR 19.201(b)).

C. Offerors that are selected for Phase A/B contracts will be required to submit new subcontracting plans in conjunction with their continuation into Phase C/D. These plans will reflect subcontracting opportunities anticipated as part of the Implementation Phase contracts. The subcontracting plans and the participation of SDBs in the performance of this phase of the contract will be evaluated in the manner described in Paragraph B above as part of the process of selecting the Implementation Phase contractor.

XIV. WITHDRAWAL OF PROPOSALS

Proposals may be withdrawn by the proposer at any time before award. Proposers are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances, which dictate termination of evaluation.

APPENDIX B

GUIDELINES FOR PROPOSAL PREPARATION AND SUBMISSION

B.1 General Guidelines

The following guidelines apply to the preparation of proposals by investigators in response to this AO. The material presented is a guide only and it is not intended to be all encompassing. The proposer should provide information relative to those items that are applicable or as otherwise required by this AO.

In order to provide a firm basis for the uniform evaluation of proposals received in response to this AO, the information concerning the Lunar Reconnaissance Orbiter (LRO) capabilities and constraints, the expected flight environments, the ground system capabilities and constraints, and the requirements for data archiving, as described in the LRO Proposal Information Package (PIP), must be used for proposal preparation (for information on accessing the PIP, see Section 3.0 of this AO).

The proposal must consist of a single bound volume with readily identified sections. All documents must be typewritten in English, use metric units, and be clearly legible. Proposals must be printed on 8.5 x 11 inches or A4 European standard stock. Proposals may contain foldouts up to 11 x 17 inches (or European equivalent), but such foldouts count as two pages each, or four pages if printed on both sides, against the page limits (see Tables 1 and 6 below). Proposals may not reference a World Wide Web site for any data or material needed to understand or evaluate the proposal, nor may any additional material be submitted by any type of electronic medium such as audio tape, videotape, floppy disk, CD, etc., unless otherwise requested in this AO.

Single- or double-column format is acceptable. In complying with the page limit, the margins all around must be at least one inch (2.5 cm) wide or wider, and the type font must not be smaller than 12-point, i.e., $\leq$ 15 characters per inch (note that if A4 paper is used, the bottom margin must be at least 4.5 cm). Figure captions must be in 12-point font, although text in the figures and in cost tables may contain smaller font as long as they are easily legible.

In order to allow for recycling of proposals, all proposals and copies must be submitted on plain white paper only (e.g., no cardboard stock or plastic covers, no colored paper, etc.). Photographs and color figures are permitted if printed on recyclable white paper. The signed original proposal (including cover page, certifications, and non-U.S. endorsements) must be bound in a manner that allows for easy to disassembly for reproduction. Except for the original copy, two-sided copies are preferred. Every page side upon which printing appears will be counted against the page limits. The other copies for review must be stapled but not otherwise bound. A searchable, PDF-formatted, exact duplicate of the proposal must be provided on Compact Disc-Read Only

Memory (CD-ROM) and attached to the proposal in a way that allows for easy access as well as retention.

In all proposals, a measurement investigation must be clearly defined. The description of any proposed instrumentation must provide adequate technical information to permit evaluation of both the concept and the practical feasibility of the investigation in terms of the LRO spacecraft resources, configurations, or special requirements necessary for successful implementation. Although many of the details of the LRO program data management procedures are not yet established, the proposal must contain the best possible description of the proposer's plans for data processing, management, and archiving, including costs, especially those for unique data management hardware and software.

B.2 Contents of Proposals

Two types of information are requested for all proposals (as described below): data for evaluation purposes and data that will be used to initiate initial contracts with the selected proposal teams. All information, however, must be consistent and, in fact, the data needed for contracts may also be used for evaluation. Each proposal must be submitted as a single bound document that contains, in addition to the *Cover Page* (see further below), a Table of Contents and a Fact Sheet, four parts as indicated in Table 1 below:

Part 1: Measurement Investigation and Implementation;
Part 2: Management, Schedule, and Cost;
Part 3: Plans for Education/Public Outreach, and Small Disadvantaged Business and Minority Education Institution; and
Part 4: Appendices (only as allowed).

Table 1. Page Limits for Investigations Providing Flight Instrumentation.

Section of Proposal	Page Limit
Cover Page/Investigation Summary	Printed from web site http://proposals.hq.nasa.gov
Table of Contents	1 p
Proposal Summary Fact Sheet	2 pp
Part 1: Measurement Investigation and Implementation	25 pp
Part 2: Management, Schedule, and Cost	25 pp
Part 3: Plans for E/PO, and Small Disadvantaged Business/Minority Educational Institutions	E/PO: 4 pp text + budget sheets; 1pp for SDB/MEI commitments.
Part 4: APPENDICES (no others permitted) 1. Cost and Budget Tables and Supporting Data 2. Resumes (2 pages maximum each) 3. Statements of Commitment from Co-Is 4. Letters of Endorsement for Non-OSS organizations (including foreign entities) 5. Draft International Participation Plan and Discussion on Compliance with U.S. Export Laws and Regulations 6. Summary of Proposal Cooperative Contributions 7. Cost and Pricing Data and Documentation for Phase A/B Contract 8. Contractual Statement(s) of Work 9. Summary of Instrument Accommodation Requirements 10. NASA PI Hardware Selection Process (only required for proposals having a NASA PI) 11. References Used for Proposal Preparation (as appropriate) 12. Abbreviations and Acronyms	No page limits but minimum size encouraged.

B.2.1 Cover Page/Investigation Summary

A *Cover Page/Investigation Summary* is an integral part of the proposal and is generated by accessing the Web site located at http://proposals.hq.nasa.gov and filling in the requested information. It is then both printed out in hard copy for submission with the proposal, as well as submitted electronically to that Web site. The *Cover Page* form requires the full names of the Principal Investigator (PI) and the authorizing institutional official, their addresses with zip code, telephone and fax numbers, and electronic mail addresses, as well as the names, institutions, and E-mail addresses of all participants, and the total NASA Office of Space Science (OSS) Cost. The *Investigation Summary* form

provides the equivalent of about one-half page of space for a brief description of the intended measurement investigation, as well as a brief statement of the objectives for Education/Public Outreach. Note that NASA enters the Summaries of all investigations selected for its various programs into a publicly accessible database. Therefore, the *Investigation Summary* should not contain any proprietary or confidential information that the submitter wishes to protect from public disclosure.

Proposers must not reformat this *Cover Page/ Investigation Summary* after it is printed, since the information thereon is automatically entered into NASA's main data base for the proposal. This form may be accessed for editing of submitted material up to the time of the proposal submission deadline by following the instructions at this Web site. Proposers without access to the Web or who experience difficulty in using this site may contact the Help Desk by E-mail at proposals@hq.nasa.gov for assistance. Finally, note that submission of the electronic *Cover Page/ Investigation Summary* does not satisfy the deadline for proposal submission.

The printed copy of this *Cover Page* that is submitted with the proposal must be signed by the PI and by the official of the investigator's organization who is authorized to commit the organization to the completion of the investigation should it be selected. This authorizing signature now also certifies that the proposing institution has read and is in compliance with the three required certifications discussed in Section 7 and shown in Appendix D of this AO; therefore, these certifications do not need to be submitted separately.

B.2.2 Table of Contents

The proposal must contain a Table of Contents that parallels the outline provided below in Sections B.2.3 through B.2.7

B.2.3 Investigation Summary Fact Sheet

The Investigation Summary Fact Sheet provides a brief description, including a table listing the major instrument parameters or specifications, of the proposed investigation. The information conveyed on this Fact Sheet should include the following: measurement objectives, schematic description of the proposed instrumentation (including figures or drawings at the proposer's discretion), objectives for Education/Public Outreach and new technology, operations overview (including how measurement operations fit with major mission characteristics), instrument project management overview (including teaming arrangement as known), schedule, and cost estimate. This Fact Sheet is restricted to two pages (preferably a double-sided single sheet).

B.2.4 Part 1: Measurement Investigation and Implementation

Part 1 of the proposal must address the proposed measurement investigation and the proposed measurement implementation. The proposal should contain enough background

information to be meaningful to a reviewer who is generally familiar with the field, although not necessarily a specialist. The main body of Part 1 will generally contain the following:

MEASUREMENT INVESTIGATION

This section of Part 1 provides an overview of the investigation being proposed, including how this investigation meets the measurement objective(s) in the AO by tracing how the measurement goals and objectives are traceable to the investigation requirements and implementation. This section must also be responsive to the evaluation criteria for Exploration Merit as described in Section 7.1 of this AO.

Measurement Goals and Objectives. This section must discuss the goals and objectives of the investigation; their value to one or more of the measurement objectives and investigations of the LRO mission and the overall objectives of the Lunar Exploration program in general; and their relationships to past, present, and future investigations and missions. It must provide a full description of the concept of the proposed investigation and the method and procedures for carrying out the investigation, including such factors as its relationship to past and any current or future efforts.

Measurement Requirements. This part should indicate in detail the kinds of measurements to be made during the mission that will be needed to carry out the proposed investigation objectives, the experiment concept for obtaining these data, and how these data would be analyzed once obtained (for example, comparison with current data or models, the production of geological maps, etc.). The measurement requirements for the investigation must be explicitly defined and be linked to the measurement objectives described in this AO. The relationship between the data products generated and the measurement objectives of the proposed investigation must be explicitly described. The quality of the data to be returned (resolution, coverage, pointing accuracy, measurement precision, etc.) and the quantity of data (bits, images, etc.) should be clearly defined, justified, and linked quantitatively to the measurement objectives. The improvement over current knowledge that the results of the investigation are expected to provide must be clearly stated. As appropriate, the proposal should indicate how the investigation relates to other mission investigations as solicited in this AO, and the specific approach being taken to coordinate measurement goals and/or to share instrument hardware.

MEASUREMENT IMPLEMENTATION

This section of Part 1 of the proposal provides a full description of the experiment hardware and software proposed to be supplied that will produce the data necessary to complete the activities described in the Investigation, including all information necessary to plan for its design, development, integration, test, ground operations, and

flight operations. The proposal must describe the technical approach for every element of the investigation to ensure that the investigation's requirements do not exceed available accommodation and/or financial resources. This section of Part 1 must be responsive to the evaluation criteria of Technical Feasibility, as well as some parts of the evaluation criteria for Implementation Risk as discussed in Section 7.1 of this AO. This section must be complete without the need for additional information for its full understanding, however, references to data or information in other Parts or Sections is acceptable to avoid redundancy.

Payload Instrumentation Description. The proposal must fully describe the proposed flight instrumentation, including any associated mechanisms, deployments and/or pointing devices. Performance requirements should be directly related to the stated investigation objectives. Strategies for any type of data compression that may be implemented should be discussed clearly. The proposal should describe any technology developments that are anticipated for development of the instrument and also describe backup strategies in the event that the expected technologies do not become available. The proposal should also describe any recognized need for supporting laboratory research or ground-based, airborne, or other activities required to support development of the instrument and/or its operation during the mission.

The proposal must outline hardware or software items proposed for development, as well as any existing instrumentation or design/flight heritage to be used. The heritage of various components of the instrument, supporting systems, and software must be clearly described. Note that, for any level of heritage claimed, cost information about the referenced sources of heritage will also be required in the section on cost-estimating methodology.

As a minimum, preliminary description of the instrument design with a block diagram showing the components, subsystems, and their interfaces must be included. In the case of a new or not yet space-qualified design, the instrument component or system must, to the extent possible, be compared based on performance, complexity, and cost to existing instruments.

The proposal shall provide a fabrication, test, and calibration concept by describing a fabrication plan, a test and verification plan, and a calibration plan at the instrument and component level. The proposal shall address any impacts in order to produce the required flight hardware and software, including but not limited to, the areas of facilities, work force, schedule, manufacturability, validation, and verification. Instrument/component testing and calibration during flight must also be described. The proposal shall include a flow diagram indicating order of assembly and tests. The description of the test concept shall include a verification matrix that describes the tests that are to be performed on components, development units, and subassemblies.

Payload/Instrument Integration. The proposal must describe all parameters of the instrumentation that are pertinent to its accommodation within the resources and configuration of the spacecraft, as described in this AO and the PIP. This information must be given in sufficient detail to permit an evaluation of both the concept and the feasibility of the instrumentation. These resources include, but are not limited to, volumetric envelope, mass, power, thermal limits, telemetry and command requirements, environmental sensitivities (e.g., to electromagnetic fields, gaseous effluences, organic contamination, etc.); any special integration constraints; pointing requirements; and onboard data processing. Mass, power, and data processing budgets should be provided. The power discussion must outline average and peak usage and provide a time profile of the power needs.

The instrument component level reserves for resources such as mass, telemetry, and power must be identified, including the allocation of reserves and margin to the instrument level. By way of definition, *contingency* (or *reserve*), when added to the current best estimate of the resource, results in the maximum expected value for that resource. Percent contingency (reserve) is the value of the contingency (reserve) divided by the value of the resource less the contingency (reserve).

> Example: An instrument has an allowable maximum expected value of
> 40 kg that includes 5 kg of reserve. The percent reserve is 5 kg divided by 35 kg (i.e., 40 minus 5) or 14%.

This section must include an illustration with key dimensions of the proposed instrument and any ancillary hardware that would be integrated onto the spacecraft. Additional descriptions of accommodation details are described in the PIP.

Since the instrument locations and the interface approaches are not finalized, proposers must identify possible electrical, mechanical, and data interfaces based on information provided in the PIP. In addition, the preferred location of the instrument/component itself on the spacecraft must be described. Where more than one choice is available, proposers must identify and justify their preference. Proposals must include a discussion of the requirements of the instrument/component data rate (peak and average), field of view, resolution, sensitivity, pointing accuracy, average data volume per day, etc. A summary of the investigation's accommodation requirements must be provided in its Appendix 9 per Table 6 (see below). Explicit guidelines for providing these requirements can be found in the PIP.

Ground Operations. The proposals shall describe all requirements for pre- and postlaunch ground operations support, site implementation, and configuration control. In particular, proposals must include an estimate of the cost of developing and maintaining a measurement operations facility at the Principal Investigator's home institution, including any support equipment (see Section 5.8 of this AO).

Flight Operations. The proposals shall describe all requirements for flight operations support, including instrument testing, calibration, and mission planning, including any special communications or near real-time ground support requirements, and indicate any special equipment or skills required of ground personnel.

Data Reduction and Validation. The proposals shall discuss the data reduction and validation plan, including a definition of archival data products and, insofar as possible, the method of their production and expected format. Proposals shall include an estimate of the cost of (ground) processor capabilities required for data reduction, validation, analysis, and archiving. The data plan should include discussion of the volume and timing of data for early release, a schedule for the submission of validated archival products to the Planetary Data System (PDS), and the plan for submission of final interpretive papers to the peer-reviewed literature, with an estimate of the costs for these activities (see Section 5.9 of this AO and the PIP).

Roles and Responsibilities. The proposals shall describe specific roles and responsibilities of the PI and of each Co-Investigator, along with a time-phasing of their activities. Every named participant must have an identified, specific function that makes a demonstrable contribution to the development and/or implementation of the investigation. A condensed description of all prospective participants' relevant background, experience, and selected publications (if appropriate) should be provided (note: this requirement is not displaced by the resumes specified below in this appendix).

B.2.5 Part 2: Management, Schedule, and Cost

This Part of the proposal contains at least three sections (Management, Schedule, and Cost) and sets forth the investigator's approach for implementing the investigation. It should, in particular, provide a discussion regarding the management of the work, the recognition of essential management functions, and the overall integration of these functions in order to meet the established review and delivery dates while controlling costs. When necessary or to avoid duplication, references can be made to other parts, sections, charts, and information.

1. Management

This section of the proposal must provide insight into the organization proposed for implementing the investigation, including the distribution of the work, the internal operations and lines of authority with delegations, together with internal interfaces and relationships with NASA, major subcontractors, and associated investigators.

Work Breakdown Structure. A Work Breakdown Structure (WBS) shall be defined in this part of the proposal that clearly links the investigation organization with the cost information in the Cost Plan (see Section B.2.5 of this Appendix). At a minimum, the elements of the proposed WBS should include the following that also need to be reflected in the Total Investigation Cost Funding Profile (see Section B.2.7 below, Tables 2, 3, and 4):

1.0 Management
1.1 Management Staff
1.2 Travel
1.3 Reviews
1.4 Mission Assurance
1.5 Measurement Investigations
1.5.1 PI Support
1.5.2 Co-I #1
1.5.3 Co-I #2
1.5.4 Co-I #3
1.5.5 Etc.
1.6 Reserves
2.0 Systems Engineering
3.0 Development
3.1 Design and Fabrication
3.1.1 Instrument Subsystem #1
3.1.2 Instrument Subsystem #2
3.1.3 Instrument Subsystem #3
3.1.4 Etc.
3.2 Integration and Test
3.2.1 Instrument Assembly
3.2.2 Functional Test
3.2.3 Environmental Test
3.2.4 Calibration
4.0 Post Delivery Support
4.1 Engineering Model Integration and Test Support
4.2 Flight Model Integration and Test (ATLO) Support
5.0 Education and Public Outreach
6.0 Mission Operations and Data Analysis
6.1 Mission Operations Development
6.2 Mission Operations Support
6.3 Measurement Data Analysis
7.0 Measurement Data Processing

7.1 Computers, Data Communications and SA Support
7.2 Algorithms and Software: flight and ground

Additional sub-elements and breakdowns to better describe the proposed investigation may be added at the discretion of the proposer.

Implementation Approach. This section of the proposal should summarize the investigator's proposed approach for implementing the complete investigation by discussing the management organization (which should be illustrated with an organization chart), the decision-making process, and the teaming arrangements. The responsibilities of team members, including contributors and institutional commitments should be discussed. Unique capabilities that each team member organization brings to the team, as well as previous experience with similar systems and equipment, should be addressed. U.S. investigations that include cooperative arrangements with foreign entities must be structured on the basis of no exchange of funds (see Section 5.11).

Roles and Responsibilities. The proposal must describe the specific roles and responsibilities of the PI, Project Manager (PM) and E/PO lead. If key project personnel (e.g., the PM, Systems Engineer, E/PO lead, etc.) are identified, their experience and qualifications should be cited here and/or in their resumes. Risk management and risk mitigation plans must be described, including the top three to five risks, descoping strategies (if relevant), and management strategies for control, allocation and release of technical, cost, and schedule reserves. When significant subcontracts are required, the acquisition strategy, including the anticipated date and length of the subcontract, and the use of performance or other incentives, should be described.

Licenses or Exemptions. The transfer of technical data or hardware to foreign parties may require export licenses or exemptions. In some cases, Technical Assistance Agreements may be needed by U.S. entities to work with foreign partners. The proposal should outline plans to meet these requirements, where applicable.

Method of Instrument Acquisition. The proposal shall describe the proposed method of instrument acquisition including the following, as applicable:

(i) Rationale for the investigator to obtain the payload instrument through or by the investigator's institution.
(ii) Method and basis for the selection of the proposed payload instrument fabricator.
(iii) Unique or proprietary capabilities of the payload instrument fabricator that are not available from any other source.
(iv) Contributions or characteristics of the proposed fabricator's payload instrument that make it an inseparable part of the investigation.

(v) Availability of supporting personnel in the institution to successfully administer the payload instrument contract and technically monitor the fabrication.

(vi) Status of development of the payload instrument, e.g., what additional development is needed, areas that need further design or in which unknowns are present, and backup options for any function or hardware requiring technology development.

(vii) Method(s) by which it is proposed to:

(a) Prepare payload instrument hardware and software specifications;
(b) Review development progress and maintain configuration control;
(c) Review design and fabrication changes;
(d) Participate in testing program;
(e) Participate in final checkout and calibration;
(f) Provide for integration of instrument/payload;
(g) Support the flight operations;
(h) Coordinate with Co-Investigators, other related investigations, and the payload integrator;
(i) Assure safety, reliability, and quality; and
(j) Control cost.

(viii) For proposals seeking NASA funding:

(a) Planned participation by small and/or minority business in any subcontracting for instrument fabrication or investigative support functions;

(b) Commitments for all major facilities, laboratory equipment, and ground-support equipment (GSE) (including those of the investigator's proposed contractors and those of NASA and other U.S. Government agencies) essential to the experiment in terms of its system and subsystems, distinguishing insofar as possible between those in existence and those that will be developed in order to execute the investigation; and

(c) The acquisition of new facilities and equipment with the lead time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

2. Schedule.

This section of the proposal should provide a project schedule covering all phases of the investigation that demonstrates how the instrument delivery dates and the LRO launch date will be met, including appropriate investigation delivery milestones. The schedule should include, at a minimum, the proposed major project review dates, and the periods for instrument development, instrument-to-spacecraft integration and test, mission operations, data analysis, and implementation of the E/PO program. The schedule should also show the proposed project's critical path from the beginning of Phase A to launch and should be supported by a brief explanation of the principal factors driving this schedule path. The proposed funded schedule reserve against delivery of the

flight instrument must be clearly identified (also see Section 5.6 of this AO). In addition, the specific tasks planned for Phase A/B should be discussed and, if applicable, correlated to tasks in the contractual Statements of Work (SOW) discussed in Part 4 of this appendix.

All schedules must be specific enough to show the logical and timely pursuit of the work, accompanied by a description of the investigator's work plan and deliverables to the LRO Project, and the responsibilities of the Co-Investigators. The proposal must also discuss the specific roles that each of the participants and their institutions intend to play in the investigation, including a statement of the portion of time that each participant expects to devote to the investigation and of the institutional resources on which each can draw.

3. Costs

Proposers must present their estimation of the total life cycle costs for the investigation for Phases A-E. This discussion must provide sufficient depth and correlation with planned project activities to allow the reliability of these estimates to be judged. This discussion must include the basis of the cost estimates that are provided and a substantiation of the cost estimation methodology used. Recommended cost reserves and cost reserve management should be discussed.

Cost Plan (for proposals requesting NASA OSS funding). The proposal must provide a Cost Plan in which the anticipated costs for all phases of the investigation are discussed. It should also discuss all contributions citing sources and estimated cost values. This discussion, along with required supporting cost tables and data that may be included in an appendix to the proposal (see Part 4 of this Appendix) where there is no page count limit. This Cost Plan will be used to assess the realism of the proposed costs. Top-level cost considerations and rationale must be discussed, and the costs for all work should be allocated and aligned with the proposed WBS as discussed in the Management section. All costs shall be consistent with the program maximum funding levels and constraints described in Section 5.7 of this AO.

In the Cost Plan, the methodology used to estimate all costs (analogies, parametric models, past experiences, cost estimating relationships, etc.) must be discussed. Budget reserve strategy, including recommended budget reserve levels as a function of mission phase, must also be discussed. Provide all assumptions used in developing cost estimates to facilitate reviewer's understanding of proposed cost estimates, particularly with regard to Government-furnished equipment and services and full cost accounting for Civil Service personnel. The proposal must provide cost information (in FY 2005, fixed year dollars) for any items that provide heritage to the investigation.

Where NASA-provided services are used, NASA Civil Service labor and supporting NASA center infrastructure must be costed on the basis of Full Cost Accounting. NASA field centers may submit full cost proposals based on the instructions in the NASA Financial Management Manual, Section 9091-5, *Cost Principles for Reimbursable Agreements* (see LRO Library). If any NASA costs are to be considered as contributed costs, the contributed item(s) must be separately funded by an effort complementary to the proposed investigation and the funding sources must be identified. Any non-NASA Federal Government elements of proposals must follow their agency cost accounting standards for full cost. If no standards are in effect, the proposers must then follow the *Managerial Cost Accounting Standards* for the Federal Government as recommended by the Federal Accounting Standards Advisory Board.

Specifically the Cost Plan should distinguish tasks and costs required for the formulation phase (Phase A/B), for the implementation phase (Phase C/D), for the operations phase (Phase E), and for investigation total life cycle. Proposers should also submit budgets for Phase E (Mission Operations and Data Analysis) and describe their expected activities for measurement operations, generation, validation, archiving of data products, and data analysis activities leading to publication of the initial results of their investigations, as well as for E/PO activities (see further below) consistent with the Phase E cost guidelines given in this AO. Note that it is expected that the funding profile for the proposed E/PO activities for this mission will normally peak during Phase E of the program. The E/PO funding guidelines of 1-2 % of a proposed PI Instrument investigation's budget refers to the mission as a whole and not each individual year. Selected proposers will have the flexibility to work within this overall funding envelope to develop a funding profile that optimizes the output of the proposed E/PO effort. All cost data provided must be provided in the formats and tables shown in Appendix 1 of Part 4 of the proposal.

Cost and Pricing of Phase A/B. In addition to the Cost Plan, proposers should submit cost data for Phase A/B, summarized by category as enumerated below and time-phased by month. These cost data will be used to facilitate timely placement of a contract for a Selected proposal. The supporting Cost Tables and backup data as discussed in Section 2.7, Part 4 of this Appendix may be included in an appendix to the proposal where there are no page count limits; however, top-level numbers and rationale should be discussed in this section.

B.2.6 Part 3: Education/Public Outreach and Small Business Plans

Within the specified page limit for the text (see Table 1 in this Appendix) and consistent with the guidance given in Section 5.3.1 and Appendix C of this AO, discuss the plans and commitments for the following subjects:

Education/Public Outreach. Describe plans for Education and Public Outreach activities of the proposed investigation, arrangements for appropriate partners and alliances, implementation of proposed activities, and dissemination of any products and materials, including a statement of intent and plans (budget and personnel) for participation in the RLEP Public Engagement Program. See Appendix C for further guidance on the content of the E/PO section of the proposal. This section should also include the E/PO Budget Summaries given in Appendix C with a single Budget Summary form for each year of the proposed effort, a Budget Summary for the total effort and, without page limit, sufficient budget narrative to fully understand the entries and demonstrate how the budget is linked to and supports the proposed program of activities.

Small Business Plans. Within a page limit given in Table 1 in this Appendix and consistent with the specific guidance given in Section 5.3.2 and Paragraph XIII of Appendix A of the AO, respectively, discuss the proposed small business plan.

B.2.7 Part 4: Appendices

The following additional information is required to be supplied with the proposal as Appendices. They have no specific page limits but their length should be minimized. No other appendices are permitted.

1. Cost and Budget Tables and Data. All detailed cost and budget data must be contained in this appendix, including the cost proposal for a contract. In addition, specific required cost data will be provided for evaluation purposes, as follows: the estimated cost of the investigation that encompasses all proposed activities, divided into two budgets, one for the development Phases A-D (up through L + 30 days) and one for the operations Phase E. The budget line items must correspond to the elements at the second level of the proposed Work Breakdown Structure with one budget line summarizing the E/PO effort. At a minimum, to ensure uniformity in submittals, the Budget Summary forms (Tables 2, 3, and 4 below) must be completed and included in the proposal. Additional budget information aligned with the proposed WBS in the format of the proposer's institution may be included without page limit, although brevity is requested.

   For budgetary costing purposes (estimation of Fiscal Year costs in Real Year Dollars), the NASA inflation index is given in the Table 5 below.

TABLE 2
TOTAL INSTRUMENT COST FUNDING PROFILE
FY Costs in Real Year Dollars (to nearest thousand), Totals in RY and Fixed Year '05 Dollars

	Formulation		SUBTOTAL ***Formulation****		*Implementation*			SUBTOTAL ***Implementation****		TOTAL ***LIFE CYCLE***	
Cost Element **	FY1	FYx	RY $	FY05$	FY1	É	FYz	RY $	FY05$	RY $	FY05$
Start to Launch + 30 Days (Phases A/B/C/D)	**Enter each cost element**										
Phase A Concept Study											
Proj. Mgmt/Miss. Analysis/Sys. Eng.											
Instrument Development											
Instrument A											
Instrument Mgmt/Sys Eng											
Hardware/Software Development											
Integration, Assembly and Test											
Other (1)											
Instrument B											
Instrument Mgmt/Sys Eng											
Hardware/Software Development											
Integration, Assembly and Test											
Other (1)											
Instrument C											
Instrument Mgmt/Sys Eng											
Hardware/Software Development											
Integration, Assembly and Test											
Other (1)											
Instrument Suite-Level Integration, Assembly and Test											
Subtotal - Instruments											
Support to S/C Integration and Test											
Launch Ops (Launch +30 days)											
Science Team Support											
Pre-Launch GDS/MOS Development											
DSN/Tracking											
Other (2)											
Subtotal Phases A-D before Reserves											
Instrument Reserves											
Other Reserves											
Total Phases A/B/C/D											
Launch + 30 Days to End of Mission (Phase E)	**Enter each cost element**										
Mission Operations & Data Analysis (including Project Management)											
DSN/Tracking											
Other (2)											
Subtotal Phase E before Reserves											
Reserves											
Total Phase E											
Launch Services											
Total NASA Cost											
Contributions (2)											
Total Contributions											
Total Mission Cost = →											

(1) Other: *list items not specific to individual instruments separately*

(2) Specify each item on a separate line; include Education & Public Outreach, facilities, etc.

* Note: Formulation = Phase A + B; Implementation = Phase C + D + E; all numbers must map to Tables 3 and 4 which are summarized by phase and by WBS.

** See ***Program Cost Elements*** document in AO Library

TABLE 3
MISSION PHASE SUMMARY OF NASA OSS COST
FY Costs in Real Year Dollars (to nearest thousand); Totals in RY and FY 05 Dollars

						TOTALS	
Cost Element	FY1	FY2	FY3	É	FYn	RY $	FY05 $
Phase A Concept Study							
Additional Phase A (if required)							
Phase B							
Phase C/D							
Phase E							
Launch Vehicle/Launch Services							
Total OSS Mission Cost							
Contributions							
Total Mission Cost							

TABLE 4
PROJECT-SPECIFIC WBS SUMMARY OF NASA OSS COST
FY Costs in Real Year Dollars (to nearest thousand); Totals in RY and FY 05 Dollars

	Phase A/B			Phase C/D			Phase E			TOTALS	
Project WBS Elements [1]	FY1	FY2	**Subtotal**	FY_{CD1}	FYÉ	**Subtotal**	FY_{E1}	FYÉ	**Subtotal**	RY $	FY05 $
WBS 1											
1.1											
1.2											
1.n											
WBS 2											
2.1											
2.2											
2.n											
WBS 3											
3.1											
3.2											
3.n											
WBS 4											
4.1											
4.2											
4.n											
WBS N											
N.1											
N.2											
N.n											
Other											
Launch Services											
Total OSS Mission Cost											
Contributions											
Total Mission Cost											

[1] Details should be provided to the lowest level of the WBS the project is currently using; The WBS should include lower-level elements comprising each individual instrument element; all figures must still map to Table 1.

Table 5. NASA New Start Inflation Index.

Fiscal Year	2005	2006	2007	2008	2009	2010	2011
Inflation Rate	0%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Cumulative Inflation Index	1.0	1.031	1.063	1.096	1.130	1.165	1.201

2. Resumes. Resumes (curriculum vitae) must be provided for each member of the investigation's team identified in Part 1 and for other key personnel (such as the Project Manager, Systems Engineer, or individuals leading the E/PO work) identified in Part 2 or 3. Each resume must clearly demonstrate experience related to the job the individual will perform on the proposed investigation.

3. Statements of Commitment from Co-Investigators. Every Co-I and Collaborator (including E/PO personnel involved in the investigation), whether from a U.S. or a non-U.S. institution (including the PI's own institution), who is identified as a participant in the proposal must submit a brief, signed statement of commitment that acknowledges his/her participation. Multiple Co-Is and/or Collaborators may sign a single statement so long as each is identified by their institution. Such statements may be facsimiles so long as an original signature is included or an E-mail so long as the identity of the sender is provided as a typed signature as well as by the header of the message. A sample such statement follows:

> "I(we) acknowledge that I(we) am(are) identified by name as Co-Investigator(s) [or Collaborator(s)] to the investigation entitled <*name of proposal*> that is submitted by <*name of Principal Investigator*> to the LRO AO, and that I(we) intend to carry out all responsibilities identified for me(us) in this proposal. I(we) understand that the extent and justification of my(our) participation as stated in this proposal will be evaluated during peer review in determining the merits of this proposal, and that, as a condition for possible selection, NASA may direct the removal of personnel from this team who are considered unwarranted for the successful completion of the proposed investigation."

4. Letters of Endorsement. Letters of endorsement must be provided from all non-OSS organizations (including foreign participants) offering goods and/or services (including the support of members of the measurement team) for the proposed investigation. Proposals lacking such letters, or including letters judged inadequate by NASA, may be rejected without further review. Proposals from foreign entities and proposals from U.S. organizations that include foreign participation must be on a no-exchange-of-funds basis and must be endorsed by the respective Government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such letters of endorsement must be signed by institutional and/or Government officials authorized to commit their organizations to participation in the proposed investigation. All letters of endorsement are to be included in and submitted with the proposal. Copies of faxed letters from non-U.S. participants may be used in the submitted proposals as long as original signed letters are received within a week of the due date for proposals, as specified in Section 8 of the AO. See also Section 5.11.1 of the AO for further information on non-U.S. proposals.

5. Draft International Participation Plan and Discussion on Compliance with U.S. Export Laws and Regulations. Investigations that include international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities must include a section discussing compliance with U.S. export laws and regulations; e.g., 22 CFR 120-130, *et seq*. and 15 CFR 730-774, *et seq*., as applicable to the scenario surrounding the particular international participation. The discussion must describe in detail the proposed international participation and is to include, but not be limited to, whether or not the international participation may require the proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or, if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available through Internet URLs http://www.pmdtc.org/ and http://www.bis.doc.gov/. Proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified, or configured systems, components, parts, etc., such as the instrumentation being sought under this AO, are generally considered "Defense Articles" on the United States Munitions List and, therefore, subject to the provisions of the International Traffic in Arms Regulations, 22 CFR 120-130, *et seq*. (see Section 5.1.1).

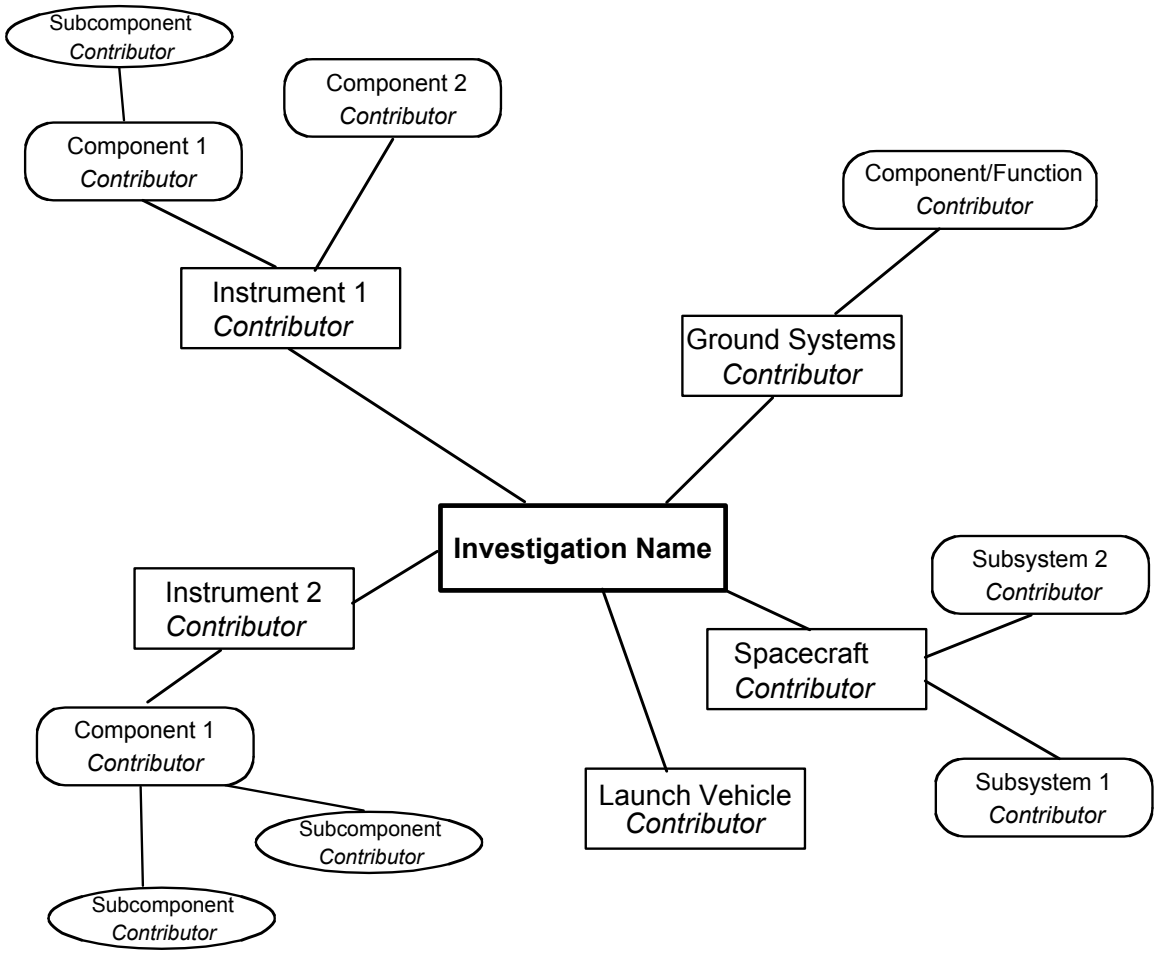
6. Summary of Proposed Cooperative Contributions. As provided in section 7.1 of the AO, each proposal will be evaluated for feasibility of the proposed approach for implementation, including cost risk (see also section 5.11). Therefore, proposals that include cooperative contributions, whether foreign or domestic, may be attributed risk during the evaluation process if (i) the approach does not have clear and simple technical and management interfaces, (ii) the proposal does not provide evidence that the contribution is within the management and technical capability of the contributing partner, and/or (iii) the proposal does not include a firm commitment for each contribution. Cooperative contributions are defined to be those that are to be provided to the proposed investigation from a domestic or foreign partner on a no-exchange-of-funds basis. In order to aid NASA in conducting an equitable assessment of risks from cooperative contributions, each proposer must provide, in addition to the commitment letter from funding sponsors of all cooperative contributions, two additional items:

• An "exploded diagram" of the investigation (see example below) that provides a clear visual representation of cooperative contributions incorporated in the proposed implementation approach. All cooperative contributions, including those that will require an international agreement or interagency memorandum of agreement, must be shown in this diagram using a unique name for the contribution as well as the identity of the contributing entity. However:

i. Since this LRO AO does not solicit proposals for the spacecraft, launch vehicle or services, or ground operations or facilities, these items need not be shown;

ii. Collaborations such as joint data analysis that do not involve contribution of flight hardware or other items critical to the investigation need not be shown; and
iii. Foreign or domestic goods and services purchased using NASA funds are not cooperative contributions and need not to be shown.

Generic Example "exploded diagram".



• A supporting table with more information that elaborates each cooperative contribution shown in the exploded diagram. This table must include, for each contribution, the following information:

i. A unique name identifying the contribution (matching the name on the exploded diagram);
ii. The identity of the providing entity, whether foreign or domestic;
iii. For foreign contributions, the identification of the funding sponsor, if different from the entity identified in item (ii) above; and
iv. The approximate value of the contribution, in U.S. dollars (i.e., the estimated cost to NASA to replace the contribution if it were not provided as planned).

7. Cost and Pricing Data and Documentation for Phase A/B Contract. To facilitate contract implementation through immediate issuance of a four-month "start up" contract, proposals must contain the following documentation:

Point of Contact. Identify the contract manager/program coordinator responsible for direct interaction with the GSFC Subcontract Manager.

Data Submittal. Complete the acknowledgement form found at: http: TBD or at: http:// TBD (if the proposer is a university) and have it executed by the proposer's cognizant authority. Complete and submit the Government Property form found at: http://TBD and the Past Performance form found at: http://TBD. Provide a letter authorizing the release of rate and other relevant information to the Goddard Space Flight Center.

Phase A/B Cost Proposal. The proposal must contain the cost information requested below for the period of Phase A/B only, summarized by cost element and time-phased by month. Labor should be proposed by work hour, not work month. A breakdown of all labor categories and associated hours to perform the effort defined in the Specimen Contract must be provided. This information should be submitted using the form found at http:// TBD or by using a computer-generated equivalent. These data provides a detailed cost proposal for performing the Phase A/B activities. Detailed plans for Phase A/B should be described, but reference may be made to other sections of the investigation proposal, as appropriate. Other guidance for developing this cost proposal includes:

Work Breakdown Structure. A Work Breakdown Structure (WBS) must be included for Phase A/B of the mission consistent with the plans set forth in the Technical Approach and Management sections of the investigation's proposal and the Statement of Work provided as Appendix 8 to the investigation proposal (see further below).

Workforce Staffing Plan. A Workforce Staffing Plan, phased by month, that is consistent with the WBS must be provided that includes all team member organizations and that covers all management, technical (measurement and engineering), and support staff. Time commitments for the PI, PM, and other key personnel should be clearly shown.

Proposal Pricing Technique. The process and techniques used to develop the Phase A/B cost proposal must be provided that includes a description of the cost-estimating model(s) and techniques used in the Phase A/B cost estimate. The heritage of the models and/or techniques applied to this estimate must be discussed, including any known differences between missions contained in the model's database and key attributes of the proposed mission and the assumptions used as the basis for the Phase A/B cost. Assumptions that are critical to cost

sensitivity in the investigation must be identified, as well as any "discounts" assumed in the cost estimates for business practice initiatives or streamlined technical approaches. Details of how these items have been incorporated in the cost estimate and will be managed by the investigation team must be given.

Phase A/B Time-Phased Cost Summary. A summary of the total Phase A/B costs consistent with Cost Element Breakdown discussed below must be provided. Since Phase A/B costs also appear in Cost Tables 2 through 4, the Phase A/B cost summary should be developed consistent with the WBS used to develop these tables and should include all costs to NASA, along with all contributed costs (shown separately). The Phase A/B time-phased cost summary should be phased by month.

Cost Elements Breakdown and Supporting Data

To effectively evaluate the Phase A/B cost proposals, NASA requires costs and supporting evidence stating the basis for the estimated costs. The categories of cost for Phase A/B should include the following:

- Direct Labor. List by labor category, with labor hours and rates for each. Provide actual salaries of all personnel, including civil service labor, and the percentage of time each individual will devote to the effort. NASA civil service labor and supporting NASA Center infrastructure must be costed on a full cost accounting basis (see above in this Appendix).
- Overhead. Include indirect costs that, because of their inclusion for common or joint objectives, are not readily subject to treatment as a direct cost (usually this is in the form of a percentage of the direct labor costs).
- Materials. Provide the total cost of the bill of materials, including estimated cost of each major item, including the lead time of critical items.
- Subcontracts. List subcontracts over $5,000, specifying the vendor and the basis for estimated costs and including any baseline or supporting studies.
- Special Equipment. List special equipment with lead and/or development time, including number of units and types.
- Travel. List estimated number of trips, destinations, duration, purpose, number of travelers, and anticipated dates.
- E/PO. Summarize the expected E/PO costs. Note that the Budget Summary forms and narrative (see Appendix C of this AO) required for E/PO activities should provide enough information for a complete understanding of those costs (also see Section 2.6, Part 3, of this Appendix B).
- Other Costs. Provide all costs not covered elsewhere.
- General and Administrative Expense. Include the expenses of the institution's general and executive offices and other miscellaneous expenses related to the overall business.

- Contributions. Contributions of any kind, whether cash or noncash (e.g., property and services) for the proposed investigation by space organizations other than OSS are welcome but must be shown as part of the Total Cost of the proposed investigation. Values for all contributions of property and services shall be established in accordance with applicable cost principles. A letter of endorsement that provides evidence that the responsible institution and/or Government officials are aware and supportive of the proposed investigation, and will pursue funding for the investigation if selected by NASA, must be submitted with the proposals for all U.S. contributions. For all contributions the constraints of Section 5.1 of this AO apply. For non-U.S. contributions to proposals, also see Section 5.11 of the AO. The cost of contributed hardware should be estimated as either: (i) the cost associated with the development and production of the item if this is the first time the item has been developed and if the mission represents the primary application for which the item was developed; or (ii) the cost associated with the reproduction and modification of the item (i.e., any recurring and mission-unique costs) if this item is not a first-time development. If an item is being developed primarily for an application other than the one in which it will be used in the proposed investigation, then it may be considered as falling into the second category (with the estimated cost calculated as that associated with the reproduction and modification alone). The cost of contributed labor and services should be consistent with rates paid for similar work in the offeror's organization. The cost of contributions does not need to include funding spent before the start of the investigation (before completing a contract with NASA). The value of materials and supplies shall be reasonable and shall not exceed the fair market value of the property at the time of the contribution.
- If any NASA costs are to be considered as contributed costs, the contributed item(s) must be separately funded by an effort complementary to the proposed investigation, and the funding sources must be identified and substantiated with a letter of endorsement from the provider. Other Federal Government elements of proposals must follow their agency cost accounting standards for full cost. If no standards are in effect, the proposers must then follow the *Managerial Cost Accounting Standards* for the Federal Government as recommended by the Federal Accounting Standards Advisory Board.
- Fee. The proposal must list any applicable fee for the submitting organization. Incentives on major contracts to the PI investigation are to be based, at least in part and as appropriate, on performance under the contract.

Start Up Contract

To facilitate the issuance of a small start up contract immediately after selection, the first four months of the Phase A/B cost data appendix must include all costs for the following activities:

Start-up Contract Tasks. The tasks to be costed for the start-up contract include, but are not limited to (References are to the PIP):

1. Participation at a measurement investigator's kick-off meeting held at GSFC within 30 days following selection.

2. Preparation of investigation products for, and participation in the Instrument Accommodation Review (Review to discuss requirements/needs to accommodate instrument in the spacecraft, see PIP section 6.3). Investigation products include:

(a) Experiment Implementation Plan (EIP; Section 7.4.4.2), which will be due at the end of the third month following selection;
(b) Safety Plan (Section 7.4.4.3), which is part of the EIP and will be due at the end of the third month following selection; and
(c) Instrument Functional Requirements Document (IFRD; Section 7.4.4.4), which will be due at the end of the fourth month following selection.

3. Working with the LRO project team to understand instrument accommodation issues, to provide a preliminary interface approach with the LRO spacecraft, and to perform engineering trade studies as needed to provide preliminary *Interface Control Document* (ICD) inputs.

4. Initiation of subcontracts with Co-Investigator (Co-I) institutions and industrial partners as appropriate.

5. Conduct reviews and meetings:
(a) Monthly Management Reviews starting at the end of the second month following selection; and
(b) Project Measurement Group meetings to complete measurement requirement definitions.
As a guide for preparing cost data proposers may use the format found on the form at http:// TBD, or alternatively a formatting of their own choosing so long as the information required is provided.

Long-Lead Procurements

Proposals shall identify and provide information on the cost for each long lead purchased part of assembly. Long lead is identified as any purchased item that would impact the investigation development critical path if not purchased within four months following selection.

Exceptions to Terms and Conditions

GSFC contracts include certain General Provisions that can be found at http:// TBD (for universities), or http:// TBD (for other cost-type contracts). A large number of exceptions, or one or more significant exceptions, to these General Provisions may substantially delay getting on contract. Proposers must provide a detailed explanation, including the rationale, for any exceptions their organizations may take.

8. Contractual Statements of Work. For investigations managed from non-Government institutions, proposals shall provide a Statement of Work to be used in a GSFC subcontract with the investigator. For investigations managed from Government institutions, the Statement of Work should be constructed as if the institution were non-Government. The Statement of Work must include general task statements for the development phase and for the operations phase of the investigation. All Statements of Work must include the following as a minimum: Scope of Work, Deliverables (including measurement data), and Government Responsibilities (as applicable). Statements of Work need not be more than a few pages in length. If more than one contractual arrangement between NASA and the proposing team is required, funding information must be provided that identifies how funds are to be allocated among the organizations.

9. Instrument Accommodation Requirements Summary. The LRO Project Office has endeavored to create an investigation accommodation environment that is flexible and robust to the interface and infrastructure requirements of the investigations that respond to this AO. Wherever possible, the Project has provided a range of interface options (e.g., a choice of data bus options) and locations within the baseline project-provided interfaces at each location.

This appendix of the proposal must summarize the accommodation requirements for proposed instrumentation following the entries in Table 6 below. Descriptions of any other pertinent accommodation information and/or instrument unique items may be added to this table. The PIP provides further guidance on how to describe and provide trade studies and cost estimates for instrument unique accommodation assumptions. Proposers may include description and trades information for any of these instrument unique accommodation approaches in their proposal appendix response to this required Instrument Accommodation Requirements Summary.

Table 6. Instrument Accommodation Requirements Summary.

Item	Description	Proposed Payload Accommodation
Total Instrument Mass (CBE plus proposed reserves)		
Volume envelope (also provide dimensioned drawing)		
Command, Telemetry, & Data Interface		
Instrument Power		
Power- Peak		
Operational		
Standby		
Power - Average		
Operational		
Standby		
Nonoperating, if applicable		
Power Profile (provide a typical operational timeline, including typical data collect duration(s)		
Pointing Requirements: Precision / Repeatability / Stability / Timing		
Azimuth		
Elevation		
Off-Nadir		
Thermal Requirements		
Instrument survival temperature range		
Instrument operating temperature range		
Nonoperational temperature for instrument survival if required		
Output Data Volume		
Average		
Profile for typical operational timeline		
Lifetime-limiting Consumables (list consumables & associated limits)		
Known Operating Constraints (e.g., daylight only, dark only, cold only, no sun looks, etc.)		
Radiation sources (list material and strength)		
Source(s) internal to instrument		
Source(s) required for test and calibration activities at GSFC		

10. NASA PI Hardware Selection Process (applicable only for proposals that have NASA employees as Principal Investigator). Proposals headed by NASA employees as the Principal Investigators must contain the following information concerning the process by which non-Government participants were included in the proposal: (i) indicate that the supplies or services of the proposed non-Government participant(s) are available under an existing NASA contract; (ii) make it clear that the capabilities, products, or services of these participant(s) are sufficiently unique to justify a sole source acquisition; or (iii) describe the open process that was used for selecting proposed team members. While a formal solicitation is not required, the process cited in (iii) must include at least the following competitive aspects: A notice of the opportunity to participate to potential sources, submissions from and/or discussions with potential sources, and the objective criteria for selecting team members among interested sources. The proposal must also address how the selection of the proposed team members followed the objective criteria and is reasonable from both a technical and cost standpoint. The proposal must also include a representation that the Principal Investigator has examined his/her financial interests in or concerning the proposed team members and has determined that no personal conflict of interest exists. Finally, the proposal must provide a certification by a NASA official superior to the Principal Investigator verifying the process for selecting contractors as proposed team members, including the absence of conflicts of interest.

If a proposed team member will perform a substantial portion of the measurement investigation, selection of the NASA PI's proposal under this AO satisfies competition requirements for the team member's proposal including any hardware or routine support service to be provided by the team member. If a non-Government participant is only providing hardware or routine support services, a separate competition must take place or a noncompetitive procurement approved according to regulations.

11. References. This appendix provides a list of any reference documents used in preparing the proposal. Note that if the documents themselves are submitted with the proposal, they must be included within the prescribed page count; that is, they cannot be submitted as part of this or any other appendix.

12. Acronyms and Abbreviations. A list that defines all acronyms and abbreviations in the proposal should be included to facilitate the review and evaluation.

APPENDIX C

EDUCATION AND PUBLIC OUTREACH

1. E/PO Proposal Content

Based on the funding guidelines given elsewhere in this AO, the E/PO programs submitted by proposers in response to this Announcement are expected to involve the expenditure of substantial resources. It is generally expected that such E/PO programs will have a breadth and depth commensurate with these resources; will be multifaceted in nature; will address a number of different aspects of education and outreach contained in the specific criteria; and will have state, regional, or national scope. RLEP Public Engagement program will also be planning and implementing a number of national efforts. Therefore, the E/PO programs associated with PI proposals may be more focused and regional in nature and will be judged accordingly. The long-range goal of having Instrument PI's (and their Teams) associated with individual Lunar missions involved in E/PO is to establish a network of Lunar scientists across the country who are both carrying out their own E/PO programs and acting as local agents for the Lunar Program's national efforts. During Phase A/B, the proposer's E/PO plans may require adjustment to support RLEP E/PO initiatives.

The Education and Public Outreach (E/PO) element of the proposal should provide a summary of the E/PO benefits offered by the investigation beyond the purely measurement benefits. This section of the proposal should contain a description of E/PO objectives and the planned activities to be undertaken to achieve those objectives; demonstrate how those plans will actually be implemented; discuss how the program will be evaluated; describe the intended involvement of the Principal Investigator and/or key measurement team members in the E/PO effort; address the involvement of educational personnel, as well as plans/commitments for partnerships and collaborations with education and outreach organizations; describe how the effort will be organized and managed (including the identification of key personnel who will be actually responsible for overseeing and implementing the E/PO effort); and explain the requested E/PO budget showing how that budget is related to and supports the planned program. Plans for developing and disseminating education/outreach products and materials, for contributing to the training of underserved and/or underutilized groups in science and technology, and for coordination of the proposed E/PO program with the RLEP Public Engagement program should be addressed. Details of organizational and management arrangements described in the Management and Cost Plan may be included by reference and do not have to be repeated in this section of the proposal. Letters of support/commitment from partners and resumes of key E/PO personnel must be included in the appendices to the proposal.

2. E/PO Evaluation Criteria for Principal Investigator Instrument Proposals

The principal elements considered in evaluating an E/PO proposal are its intrinsic merit, cost, and its relevance to NASA's objectives. The failure of a proposal to be rated highly in any one of these elements is sufficient cause for the E/PO proposal to be declined. Note that intrinsic merit is weighted approximately twice that of cost and relevance, which are weighted equally.

The factors that contribute to intrinsic merit, cost, and relevance to NASA objectives and indicators of alignment with these factors are presented in the *"Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria (March 2004)"* which can be found linking through "*Education"* at the Web site http://spacescience.nasa.gov/ or in the LRO Program Library.

Plans for coordination of the proposed activities with the umbrella RLEP Public Engagement program will also be explicitly considered in the evaluation process.

In all cases, note that while creativity and innovation are certainly encouraged, neither of these sets of criteria focuses on the originality of the proposed effort. Instead, NASA seeks assurance that the proposer is personally committed to the E/PO effort and the PI and/or appropriate research team members will be actively involved in carrying out a meaningful, effective, credible, and appropriate E/PO activity; that such an activity has been thoughtfully planned and will be carefully executed; and that the proposed investment of resources will make a significant contribution toward meeting OSS E/PO plans and objectives. OSS seeks E/PO efforts that are conducted just as thoroughly and professionally as the measurement and engineering aspects of the missions themselves.

To aid proposers in the preparation of their proposals, as well as to ensure that reviews are carried out on a consistent basis aligned with the OSS Education Strategy and Implementation Plan, an *Explanatory Guide* to the E/PO evaluation criteria has been prepared and may be found by linking through "*Education"* at the Web site http://spacescience.nasa.gov/. In addition, the NASA Education and Public Outreach Strategic Goals, Objectives, and Focus Areas have been included at the end of this appendix.

3. Assistance for the Preparation of E/PO Proposals

NASA OSS has established a nation-wide support network of space science education/public outreach groups whose purpose is to directly aid space science investigators in identifying and developing high quality E/PO opportunities. This support network provides the coordination, background, and linkages for fostering partnerships between the space science and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. Of particular interest are two elements of this network (which are also described in more detail in the OSS education/outreach implementation plan referred to above):

- Four OSS science theme-oriented E/PO "Forums" are sponsored by NASA OSS to help orchestrate and organize in a comprehensive way the education/outreach aspects of OSS space science missions and research programs, and provide both the space science and education communities with ready access to relevant E/PO programs and products; and
- Seven regional E/PO "Broker/Facilitators" are sponsored by NASA OSS to search out and establish high leverage opportunities, arrange alliances between educators and OSS supported scientists, and help scientists turn results from space science missions and programs into educationally appropriate activities suitable for regional and/or national dissemination

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate alliances. However, while these Forums and Broker/Facilitators are commissioned by OSS to provide help, the responsibility for actually developing an E/PO program and writing the proposal is that of the proposer. Points of contact and addresses for all the E/PO Forums and Broker/Facilitators may be found at the link "*Education*" from the menu of the OSS homepage at http://spacescience.nasa.gov/.

4. Format for Submission of E/PO Budget Information.

In order to properly assess the likelihood that a successful E/PO program is planned and will be carried out, this appendix to the proposal should summarize its intended E/PO budget using the following tabular format, with one such Budget Summary for each year of the prime investigation and one that summarizes the entire period of performance. In addition to these Summary forms, the additional narrative material must be provided that documents and explains the needs for the costs that are listed.

BUDGET SUMMARY for EDUCATION/PUBLIC OUTREACH PROPOSAL

For (check one):
__ Total Period of Performance from (M/Y) _____ to _____
/or/
__ Year ____ of ____ from (M/Y) _____ to _____

1. Direct Labor (salaries, wages, and fringe benefits)	
2. Other Direct Costs:	
a. Subcontracts	
b. Consultants	
c. Equipment	
d. Supplies	
e. Travel	
f. Other	
3. Facilities and Administrative Costs	
4. Other Applicable Costs	
5. SUBTOTAL--Estimated Costs	
6. Less Proposed Cost Sharing (if any)	
7. Total E/PO Estimated Costs	

NASA EDUCATION AND PUBLIC OUTREACH
STRATEGIC GOALS, OBJECTIVES, AND FOCUS AREAS

<u>NASA Mission Statement</u>: To Inspire the Next Generation of Explorers

<u>NASA Strategic Goal 6</u>: Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.

NASA Objectives	OSS Areas of Emphasis
1. Increase the number of elementary and secondary students and teachers who are involved in NASA-related education opportunities.	a) Provide opportunities for students to work directly with NASA space science missions, facilities, and data. b) Take advantage of the advanced-technology nature of the Space Science Enterprise's programs to develop new materials and new programs in technology education

2. Support higher education research capability and opportunities that attract and prepare increasing numbers of students and faculty for NASA-related careers.	Continue to contribute to the professional training of scientists by supporting research assistantships and postdoctoral opportunities offered through Space Science Enterprise research awards and through other NASA research and higher education programs.

3. Increase the number and diversity of students, teachers, faculty, and researchers from underrepresented and underserved communities in NASA-related science, engineering, mathematics, and technology (STEM) fields.	Increase opportunities of diverse populations to participate in space science missions, research, and education and outreach programs: a) Continue and expand our efforts to develop space science capabilities at minority institutions. b) Develop and enhance partnerships with special interest organizations such as professional societies of minority scientists. c) Develop working partnerships and coordinate with the diversity initiatives of scientific professional societies. d) Extend the accessibility of space science E/PO programs and products to an increasingly broad population, including girls, residents of rural areas, and persons with disabilities.

4. Increase student, teacher, and public access to NASA education resources via the establishment of e-Education as a principal learning support system.	Improve the coherence of NASA Space Science materials for educators by building a framework that will show the appropriate standards-aligned sequencing of space science topics throughout the K–12 years for the materials being produced by individual missions.

NASA Strategic Goal 7: Engage the public in shaping and sharing the experience of exploration and discovery.

NASA Objectives	OSS Areas of Emphasis
1. Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research, and exploration missions. a) Improve science literacy by engaging the public in NASA missions and discoveries, and their benefits, through such avenues as public programming, community outreach, mass media, and the Internet.	a) Build on strong mutual interests between the Space Science Enterprise and the science center, museum, and planetarium communities by continuing to provide space science content, materials, and technical expertise to support the development of exhibitions and programs. b) Seek out and capitalize on special events and particularly promising opportunities in our scientific program to involve the public in the process of scientific discovery and to use space science to improve STEM education at all levels. c) Enrich the science, mathematics, engineering, and technology education efforts of community groups such as the Girl Scouts, 4-H Clubs, and Boys and Girls Clubs through the introduction of space science.

APPENDIX D

CERTIFICATIONS

The texts of the following required certifications are included for reference only. Submission of the signed printout of Web Cover Page (see Section 2.1 of Appendix B) certifies compliance with these certifications.

1. Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

2. Certification Regarding Debarment, Suspension, and Other Responsibility Matters Primary Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1265.

A. The applicant certifies that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification;

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion -- Lowered Tier Covered Transactions (Subgrants or Subcontracts)

(a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.

(b)Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

3. Certification Regarding Lobbying

As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over $100,000, the applicant certifies that:

(a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form -- LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

APPENDIX E

ACRONYMS AND ABBREVIATIONS

AMMOS	Advanced Multi-Mission Operations System
AO	Announcement of Opportunity
ATLO	Assembly, Test, and Launch Operations
CBE	Cost Baseline Estimate
CDR	Critical Design Review
CD-ROM	Compact Disk- Read Only Memory
CEQ	Council on Environmental Quality
Code S	Office of Space Science, NASA Headquarters
Co-I	Co-Investigator
COMPLEX	Committee for Planetary and Lunar Exploration
CR	Confirmation Review
CSR	Concept Study Report
DSMS	Deep Space Mission Systems
DSN	Deep Space Network
EDL	Entry, Descent, & Landing
EEE	Electrical, Electronic, and Electromechanical
ELV	Expendable Launch Vehicle
EM	Engineering Model
E/PO	Education and Public Outreach
ERD	Environmental Requirements Document
FAR	Federal Acquisition Regulation
FM	Flight Model
FMECA	Failure Modes, Effects, and Criticality Analysis
FTE	Full Time Equivalent
FY	Fiscal Year
GDS	Ground Data System
GFE	Government Furnished Equipment
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
HBCU	Historically Black Colleges and Universities
ISO	International Organization for Standards
JSC	Johnson Space Center
LOA	Letter of Agreement
LOE	Letter of Endorsement
LOI	Lunar Orbit Insertion
LRO	Lunar Reconnaissance Orbiter
MEI	Minority Educational Institution
MI	Minority Institution
MMO	Mission Management Office
MOS	Mission Operations System

MOU	Memorandum of Understanding
MPO	Mars Program Office
MRO	Mars Reconnaissance Orbiter
NAIF	Navigation and Ancillary Information Facility
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Protection Act
NFS	NASA FAR Supplement
NOI	Notice of Intent
NPD	NASA Policy Directive
NPG	NASA Procedures and Guidelines
NPR	NASA Procedures and Requirements
NRC	National Research Council
OSS	Office of Space Science
PDR	Preliminary Design Review
PDF	Portable Document Format
PDS	Planetary Data System
PI	Principal Investigator
PIP	Proposal Information Package
PM	Project Manager
PP	Planetary Protection
PPO	Planetary Protection Officer
RHU	Radioisotope Heating Unit
PSG	Project Science Group
PSIG	Project Science Integration Group
RLEP	Robotic Lunar Exploration Program
RPS	Radioisotope Power Supplies
RTG	Radioisotope Thermal Generator
RY	Real Year
S/C	Spacecraft
SDB	Small Disadvantage Business
SE	Support Equipment
SIC	Standard Industrial Groups
SOPC	Science Operations and Planning Computer
SOW	Statement of Work
SPAH	Sample Preparation and Handling
SScSC	Space Science Steering Committee
TMC	Total Mission Cost
TRL	Technology Readiness Level
UHF	Ultra-High Frequency
URL	Uniform Resource Locator
WBS	Work Breakdown Structure
WOSB	Woman-Owned Small Business

APPENDIX F

PROPOSAL CHECKLIST

The following proposal checklist will be used by NASA to perform a compliance check on all proposals received in response to this AO.

Administrative Compliance	
1. Delivered on time	§8.0
2. Includes printed copy of electronically-submitted Cover Page and Proposal Summary	Appendix B
3. Includes original PI signature	§6.6, Appendix B
4. Includes original authorizing official signature	§6.4
5. Correct number of copies delivered	§6.6
6. Proposal meets page limits	Appendix B
7. Each proposal accompanied by a CD copy	§6.6
8. Meets general guidelines (one volume original easy to disassemble, one inch margins, maximum 15 characters/inch -- approximately 12 pt font)	Appendix B
9. Includes only required appendices	Appendix B
10. Budgets submitted in required formats	Appendix B
11. Includes letters of endorsement from all organizations contributing critical goods and services, including those for Co-Is, from all major participants, and from any required funding organizations	§5.1, Appendix B
12. Includes letters of endorsement from participating non-U.S. institutions	§5.11.1, §8.0, Appendix B
Programmatic Compliance	
13. Addresses goals and objectives of the solicited mission	§1.2, §2.0
14. Responsive to the data archiving requirements	§5.9
15. Proposes an investigation versus just an instrument or technology	§2.0, §5.2

Technical Compliance	
16. Complete investigation (Phases A-E) proposed	§1.1, §5.6
17. Team led by a single PI	§5.1
18. Proposed budget within cost constraints	§5.7
19. Contributions within contribution limit	§5.1
20. Phase A/B costs within cost limits	§5.7
21. Cost reserves proposed per AO direction	§5.7
22. Includes Contract Start required information	Appendix B
23. Includes E/PO, and SDB commitments	§5.3, Appendix B